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May 1957

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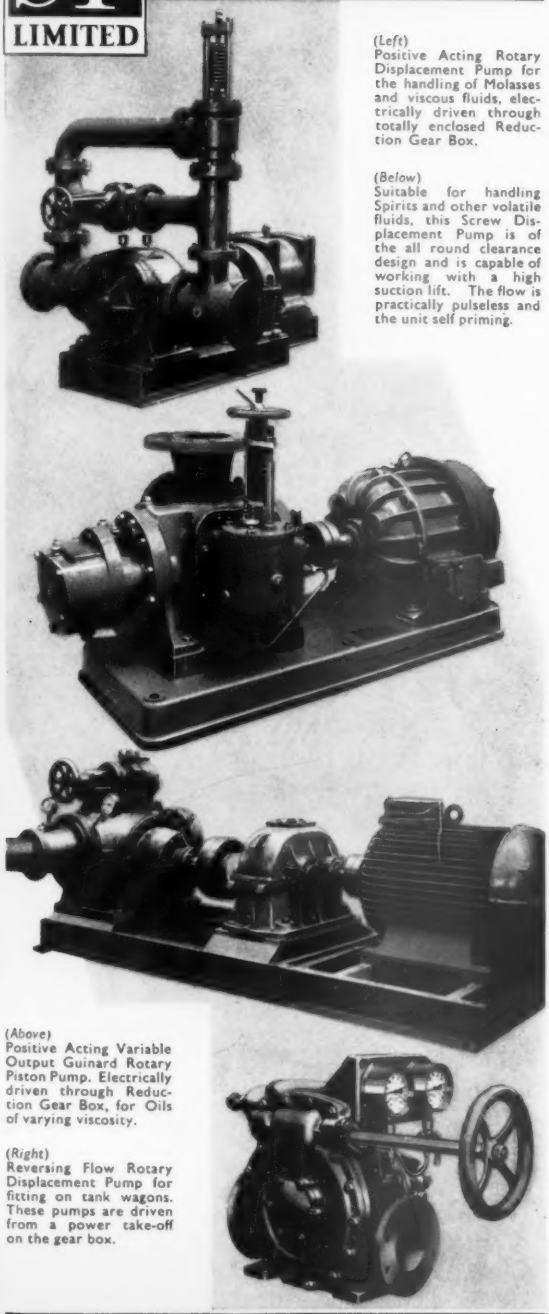

(Left)
Positive Acting Rotary Displacement Pump for the handling of Molasses and viscous fluids, electrically driven through totally enclosed Reduction Gear Box.

(Below)
Suitable for handling Spirits and other volatile fluids, this Screw Displacement Pump is of the all round clearance design and is capable of working with a high suction lift. The flow is practically pulseless and the unit self priming.

(Above)
Positive Acting Variable Output Guinard Rotary Piston Pump. Electrically driven through Reduction Gear Box, for Oils of varying viscosity.

(Right)
Reversing Flow Rotary Displacement Pump for fitting on tank wagons. These pumps are driven from a power take-off on the gear box.

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Contents

TECHNIQUES OF FORECASTING OIL DEMAND
BY *H. E. Barry* 119
IP COUNCIL AND OFFICERS 1957-8 123
AROUND THE BRANCHES 124
PERSONAL NOTES 126
NOTES OF THE MONTH 127
OIL EXPLORATION IN THE U.K.
BY *I. Gillespie* 132
ATOMIC ENERGY FOR PETROLEUM PROCESSING ... 135
CONFERENCES, COURSES, AND EXHIBITIONS 136
COAL AS A RAW MATERIAL 137
PIPELINE INTO PERSIA 139
ESSO'S LARGEST TANKER LAUNCHED 140
MECHANIZED BOTTLE WASHING 141
MANKIND'S STAKE IN MIDDLE EAST OIL 142
PETROLEUM IN PARLIAMENT 144
BOOKS AND FILMS 145
TRADE LITERATURE, ETC. 147

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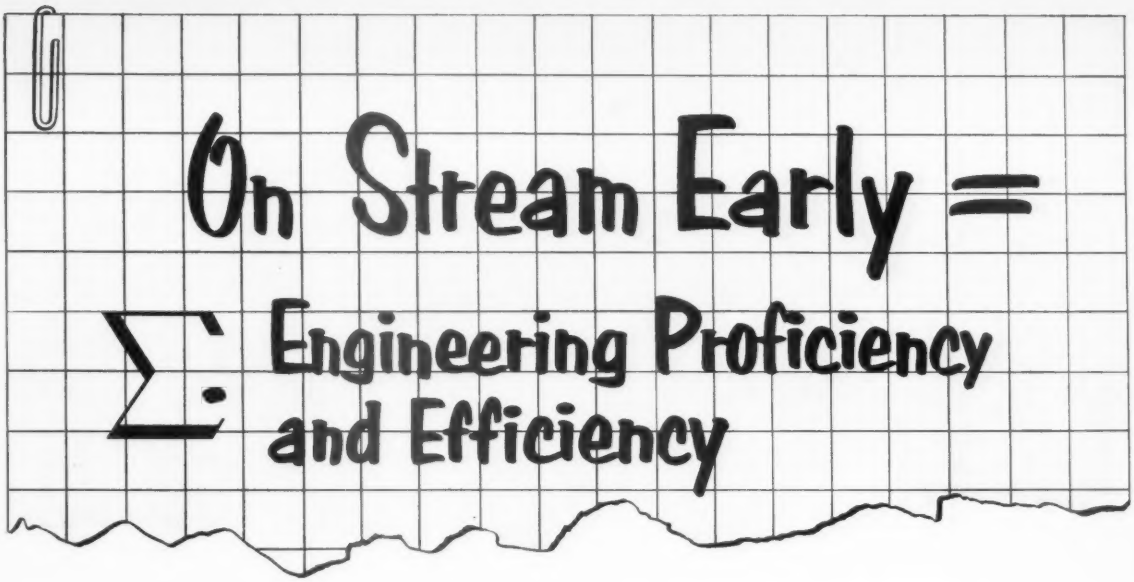

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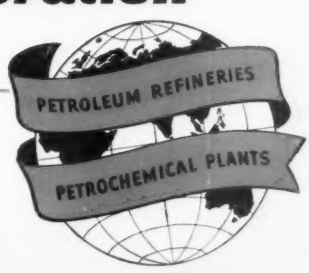

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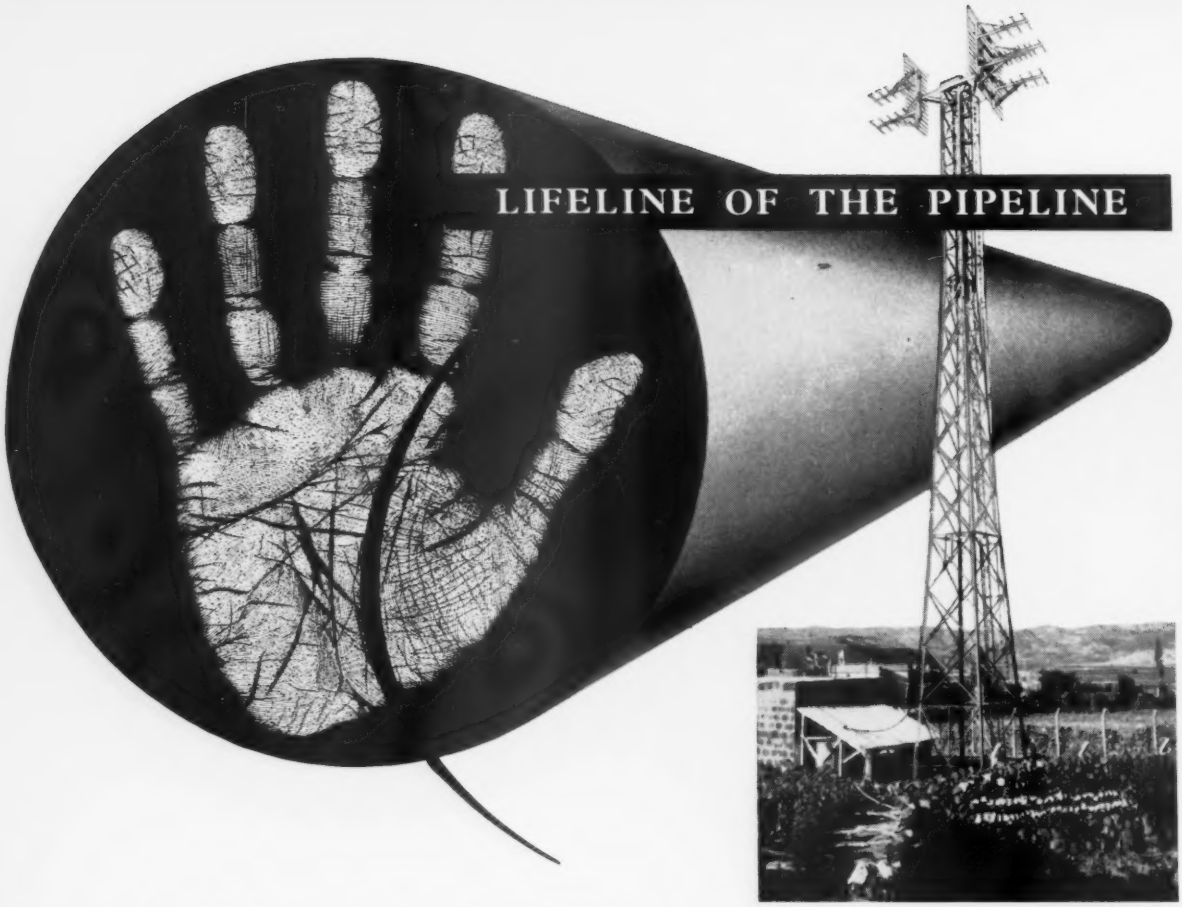

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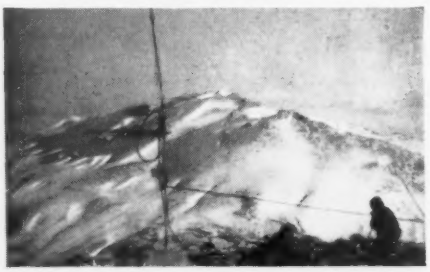
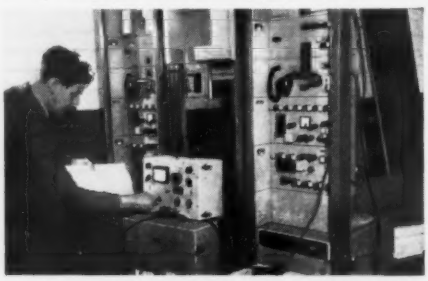
The repeater station at Dahr Safra installed for the Iraq Petroleum Company. Duplicated power supply and automatic change-over facilities ensure uninterrupted service of this 4-channel VHF link.



A Marconi survey engineer tests for signal strengths at a lonely mountain site during the radio-propagation survey along the trans-Iranian pipeline route.



Development work at Chelmsford on HM 181 VHF multi-channel equipment. Eighty-four of these will be supplied for the trans-Iranian scheme.

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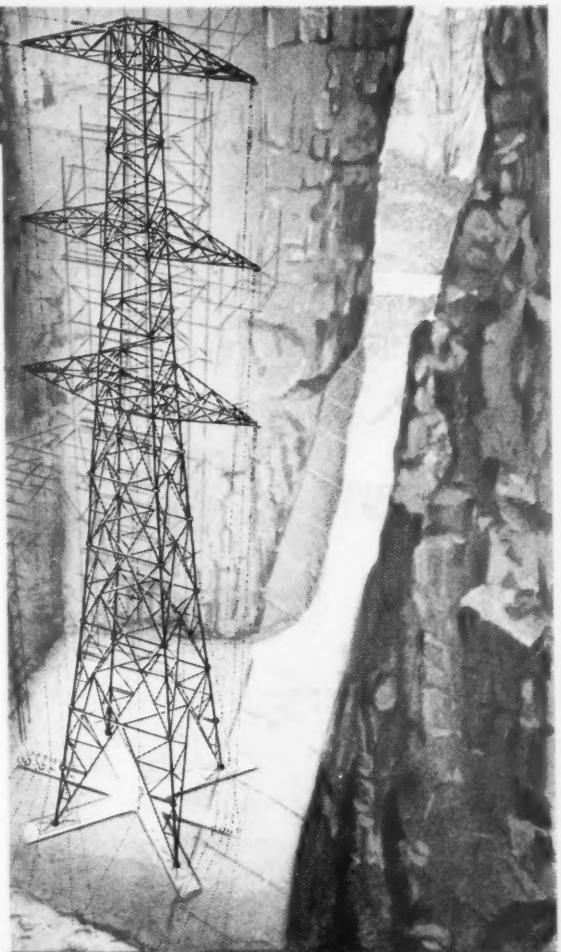

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A disused limestone quarry in Derbyshire has provided the ideal site for this unique testing station, recently opened by Stewarts and Lloyds. The floor measures 100 ft. by 60 ft. and its sheer walls, 160 ft. high, enable horizontal pulls to be applied by short ropes; they also protect structures under test against chance wind loads.

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Many years ago an Italian organ grinder and his monkey used to entertain the quarrymen from the bridge spanning the entrance to the quarry. After the performance the monkey was lowered on a rope to make a collection. One day the rope broke and the monkey was killed; the quarry has been known as the 'Monkey Hole' ever since.

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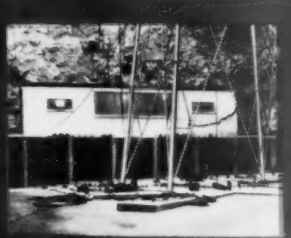
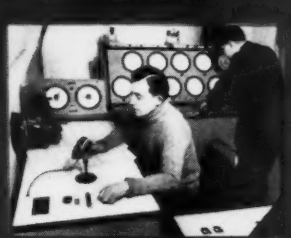
Below Left: The Test House; *Centre:* The Winches; *Right:* The Control Desk





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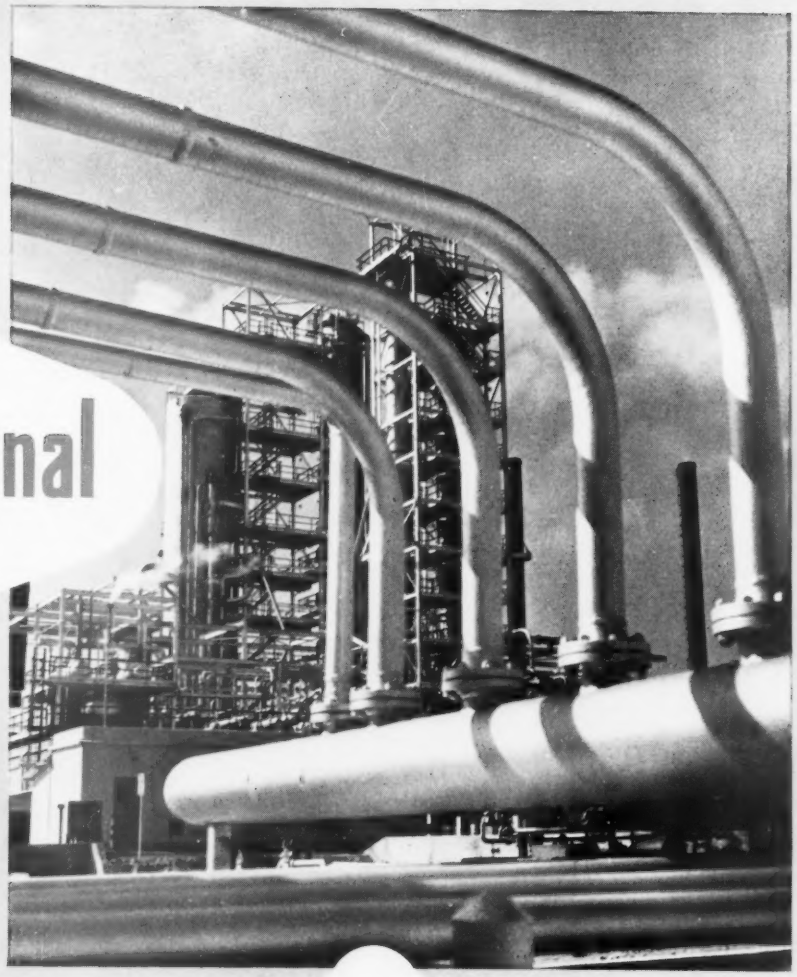

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Crude Distillation Unit No. 2, Cardón Refinery.
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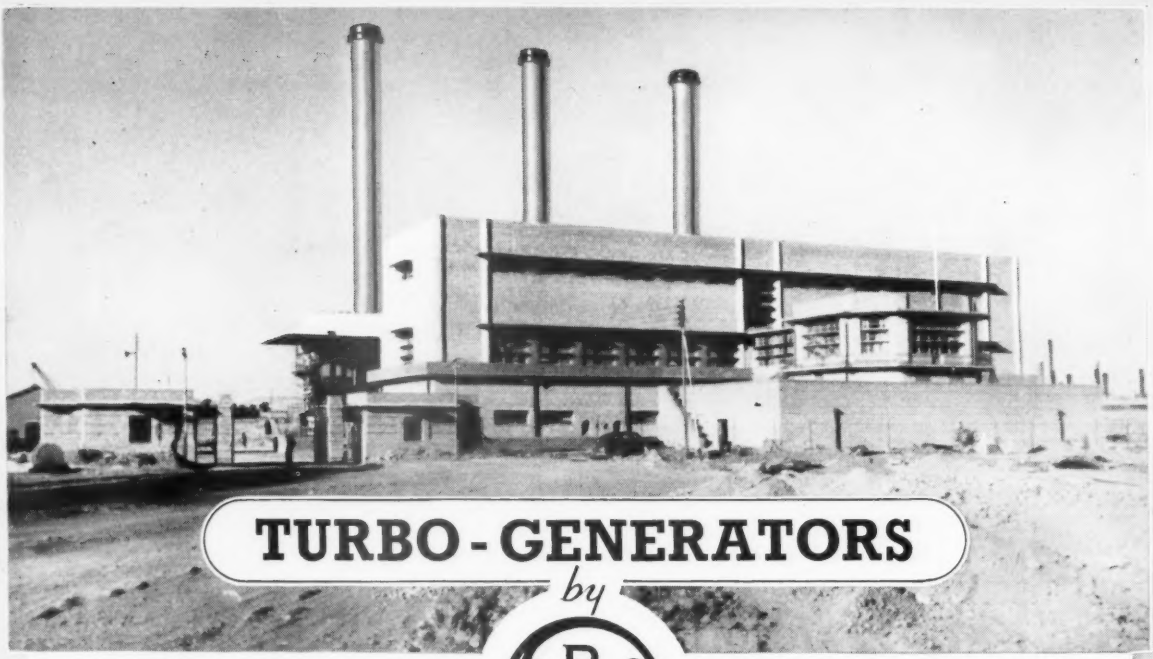

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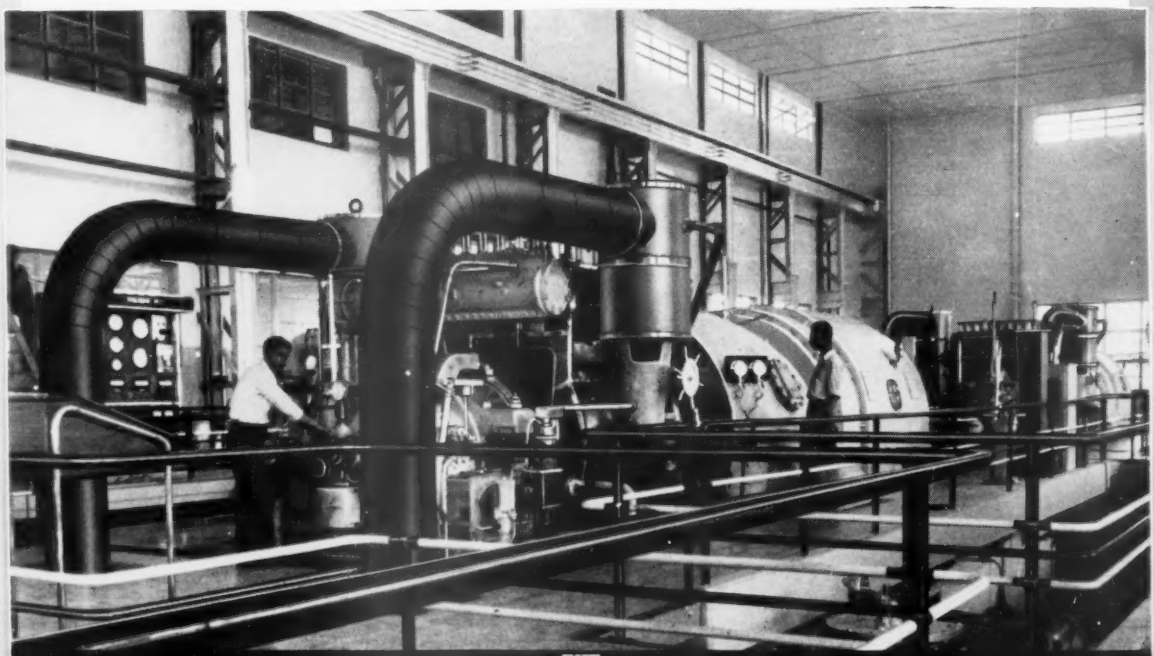

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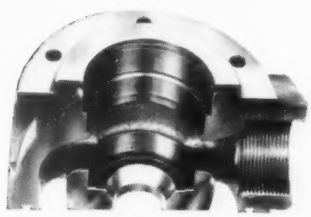

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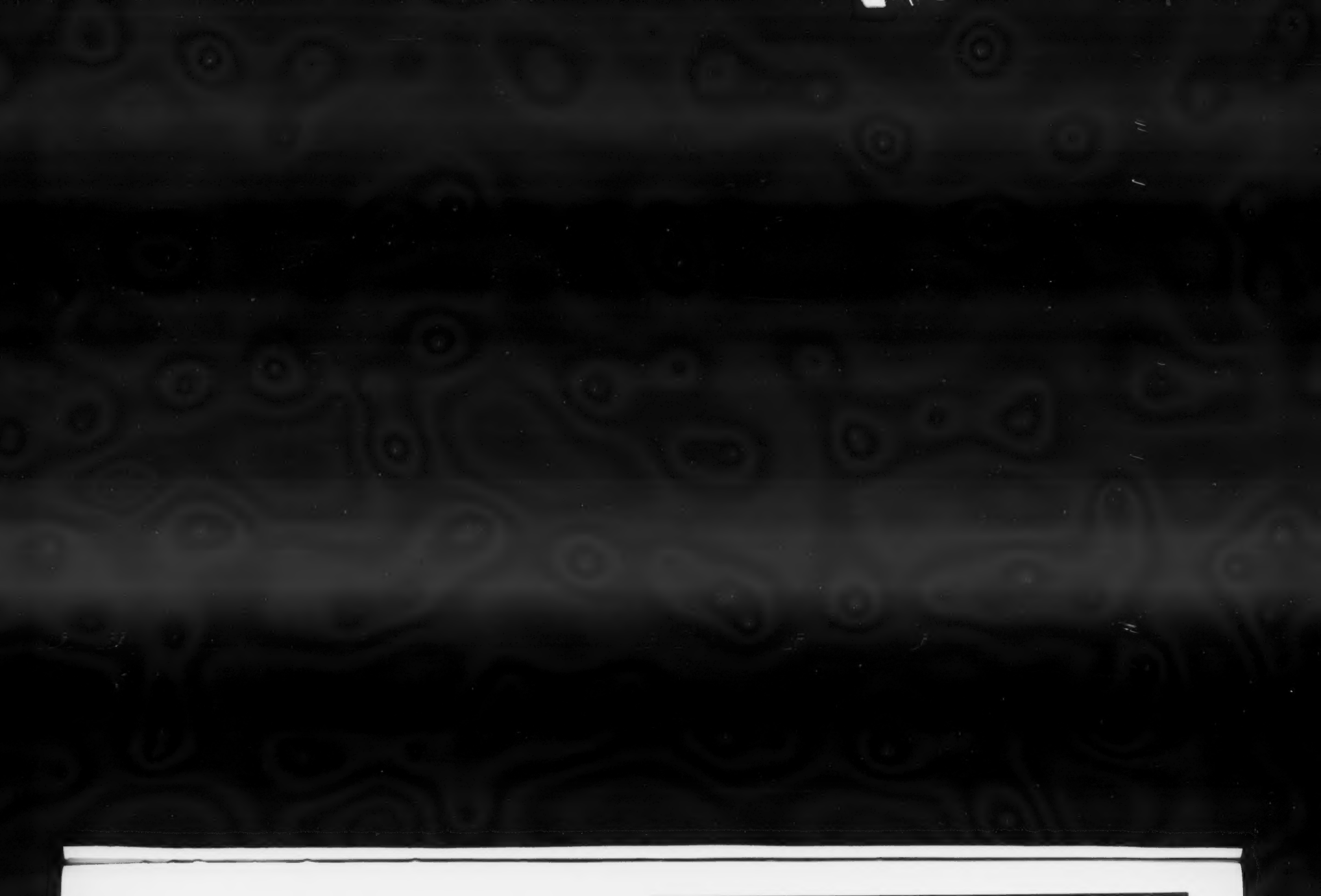

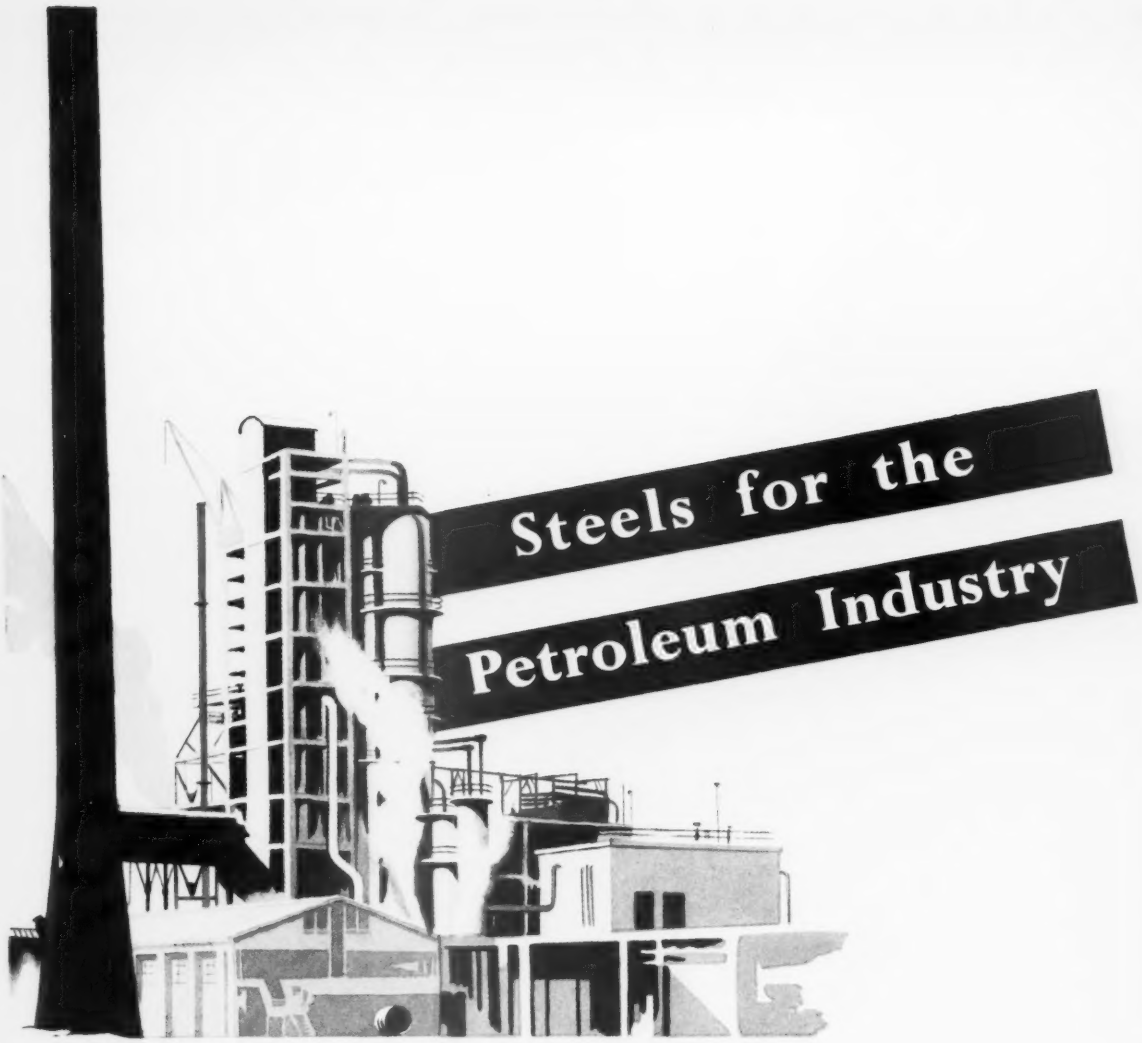

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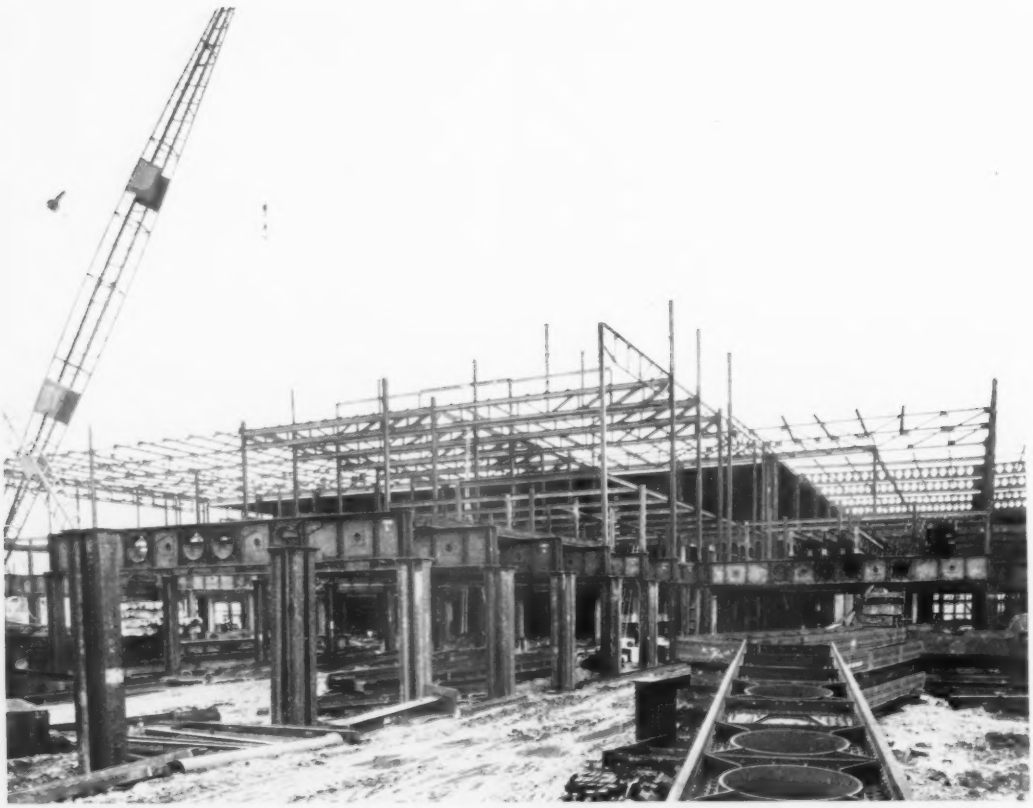

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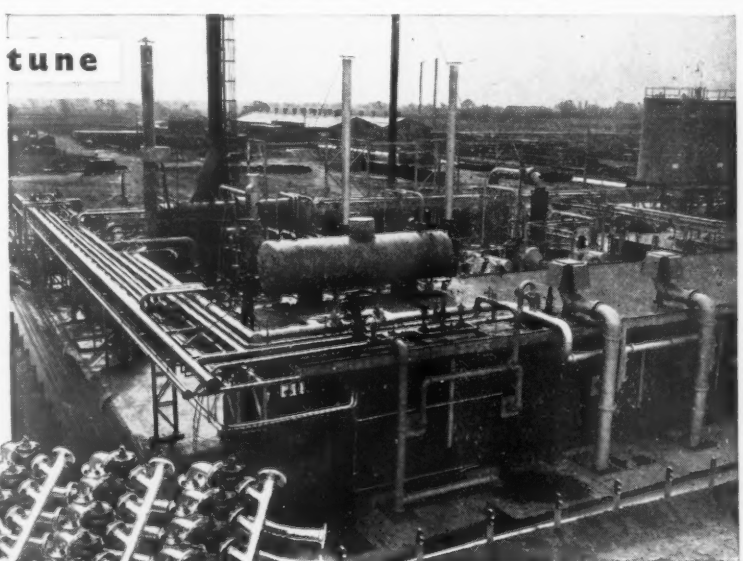

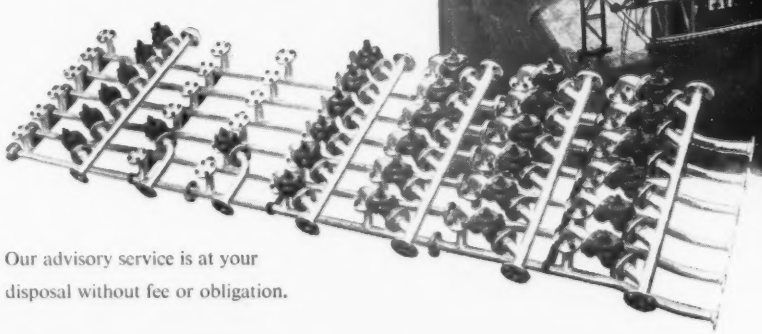

The photograph above shows the Sulphur Recovery Unit at the Shell Stanlow Refinery.

(Left) A Solvent Distribution Manifold for I.C.I. Ltd.

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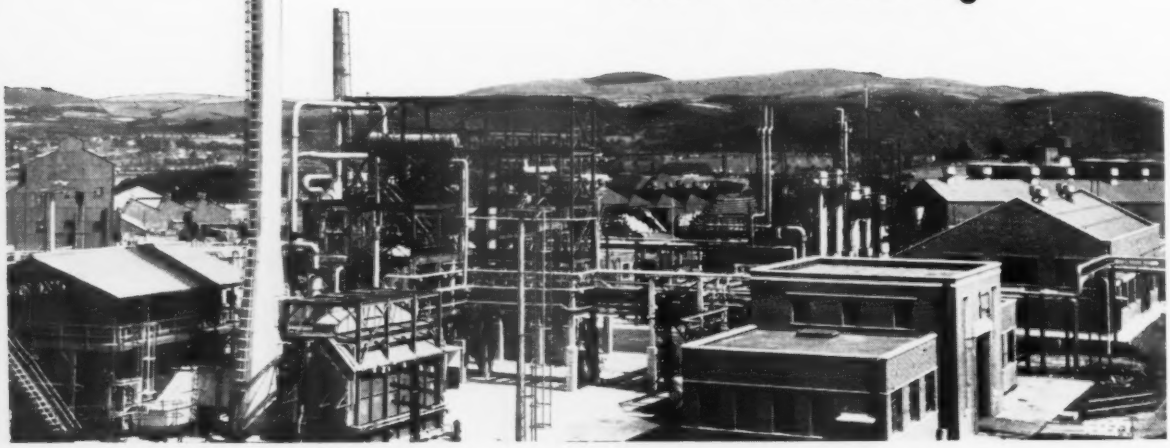
Llandarcy Autofiner, South Wales. Photo by courtesy of The British Petroleum Co., Ltd.

Catalysts for Research and Industry



Commissioned in July 1952, The British Petroleum Co. Autofiner at Llandarcy uses Spence cobalt and molybdenum oxides on alumina catalyst, and has been in continuous operation since that date for the desulphurisation of tractor fuel.

The initial charge of catalyst continues to give entirely satisfactory service. Examination at the end of two years confirmed that the activity and mechanical strength of the catalyst were quite unimpaired.

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REVIEW

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Techniques of Forecasting Oil Demand

By **H. E. BARRY (Member)**

Mr Barry, an economist at Shell-Mex and B.P. Ltd, read the following paper to a meeting of the IP Economics and Operations Group on 14 *November* 1956.

According to the *Concise Oxford Dictionary*, technique is defined as "mechanical skill in art", and forecasting must be considered an art! It is not an exact science, and it must be made quite clear from the outset that there is no one ideal method of forecasting oil demand.

Accordingly, it is not possible to supply all the answers to forecasting problems in a short paper. Nor is it necessary to underline the importance of estimates being as accurate as possible. Long-term estimates of oil demand, and of a given company's share in that demand, have a vital bearing on decisions affecting exploration programmes, and refinery building and tanker building programmes.

It has been said that a study of past oil consumption suggests the formulation of four "laws of growth", which appear to be followed in respect both of the United States and the rest of the free world, and hold for overall consumption as well as individual products. The first law is that for periods of time, oil demand follows what may be called a compound interest curve. The other laws, however, so modify this first law that it appears that the inverted commas which the authors put round "laws of growth" are fully justified!

The consideration of past trends is the basis of almost all techniques for establishing future trends. It may perhaps be pertinent to recall the story of the cowboy who was asked what he did when, alone, he stumbled on a bunch of Injuns. He said "I surrounded 'em". Likewise, when faced by a forecasting problem—surround it. Tackle it from different sides, in different ways, and the chances are that mutual confirmation of the answer, there or thereabouts, will be obtained from several of the methods used.

It is proposed now to consider in some detail three methods which have been found useful in long-term forecasting, all of which can in some measure be brought to bear on any given problem. The first of these is mathematical prediction. Suppose the moving annual total consumption of a product is plotted on a graph. Any curve so shown has its mathematical approximation, straight line, compound interest curve (or log-straight line), parabola, cubic, or a curve of a higher order. The appropriate curve can usually be identified by eye and fitted by the method of Least Squares. Although such curves can properly be used only for interpolation, *i.e.* obtaining readings at intermediate points within the limits of the data, they can, cautiously and weighing the risks, be used for prediction too.

The risks involved in relying solely on this method may be illustrated by what was experienced with motor spirit at the end of 1953. Chart 1 shows the moving annual total for U.K. motor spirit consumption for 1950-53. Two curves were fitted, a straight line and a cubic curve. It will be seen that the cubic is a very close fit, and accordingly might well have been used for projecting the position at, say, the middle of 1956. This would have given a figure of 9,590,000 tons. A straight line projection, on the other hand, gave a figure of 6,243,000 tons, and in the event, the actual figure was 6,332,000 tons. This shows how risky it is to rely solely on the projection of a mathematical trend; it does, however, indicate the direction in which the trend is moving.

In this first example, the total consumption of a product was considered, and the next line normally followed would be to consider the trends in the end-uses of the product. Thus, continuing on motor spirit, estimates are made of the consumption by various classes of users—cars and motor-cycles, taxis, public service vehicles, goods vehicles, agricultural use, industrial use, etc. The trends of all of these end-uses are examined, and it would be most unusual to find that they were all of the same nature. On Chart 2, just two—the most important two—private car consumption and goods vehicle consumption have been picked out, and it will be seen that the trends are of an entirely different nature. It is possible to go on and break down further the trend for goods vehicles into, say,

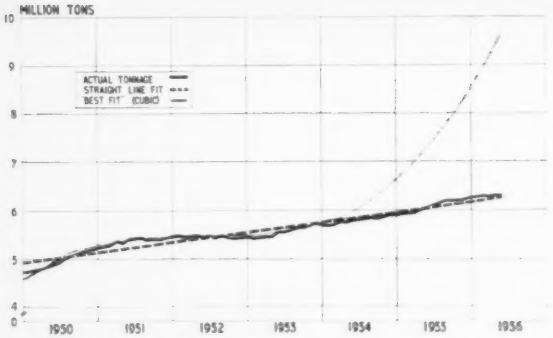


Chart 1. *U.K. motor spirit consumption*—1950-56.

light vans and other vehicles. In the case of light vans, a rising standard of living means that more and more people want their groceries and vegetables, etc., delivered to the door—a reflection of economic circumstances. In the case of other goods vehicles, there is a transfer going on from the petrol vehicle to the more efficient diesel vehicle—a technological change. These technological changes can be almost revolutionary, *e.g.* fuel oil consumption in the United States changed its growth characteristic from a 6·3 per cent annual rate between 1935 and 1945 to a 1·6 per cent annual increase since 1945 as a result of the dieselization of the railways, and the virtual disappearance of the oil-burning steam locomotive.

Reverting to motor spirit, the estimator is not satisfied, or should not be satisfied with testing the total of individual end-use estimates against mathematically derived total forecasts. The third method may be called estimating by association, and consists of establishing a significant relationship between demand for a petroleum product and some other variable which may be expected to influence the demand for the product. Thus, if motor car registrations and motor spirit consumption show a close relationship, or if consumption of fuel oil or industrial lubricants behaves in much the same way as the index of industrial production, then there is a good case for making a separate estimate of the independent variable, and then calculating from it the future values of the dependent variable, oil. This method, too, has its dangers. In the first place, as when the trend line is projected, it is anticipated that an historical relationship will hold in the future. In the second place, the successful establishment of a relationship can blind the forecaster to some of the difficulties of using it, or betray him into an almost reckless forecasting of the independent variable. An example of this is the recent study of long-term growth in passenger car demand made by the *Economist* Intelligence Unit. The growth in passenger car registration is shown to be very closely linked to "real disposable National income per head". But, in order to use this link, which in any case is itself only an indirect guide to motor spirit consumption, separate estimates must be made of future trends in population, National income, the degree of inflation, and fiscal policy—a formidable task. If this task is shirked and the independent variable estimated directly, *e.g.* that real disposable National income per head will increase by £x per year, then it will possibly be found that, analysed, this is far from agreeing with present realities. In this particular example, one would do well to check the estimate of car registration by getting at the answer another way, through vehicle production and the announced plans of vehicle manufacturers.

Chart 2. *U.K. motor spirit consumption. Two main end uses*—1950-55.

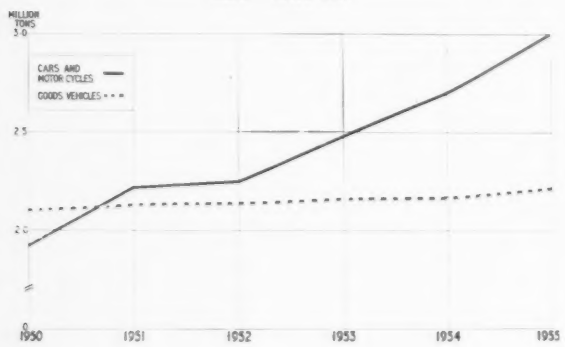


Chart 3 shows what the "surrounding process" looks like in practice. Various estimates for motor spirit consumption in the U.K. have been plotted up to 1962—the straight line fit is shown, an estimate from end use build-up, and an estimate made by applying an observed relationship between motor spirit consumption and vehicle population to the estimated future vehicle population. The estimate which is thought to represent the plausible demand for this period is also shown. It is not claimed that this estimate is correct—indeed the events of the last two weeks may well have falsified it completely—but the multiple approach indicates pretty clearly the zone where the best estimate lies.

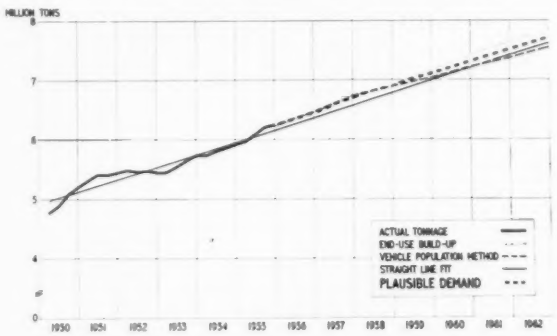


Chart 3. *U.K. motor spirit consumption*—1950-62.

Another method of forecasting petroleum demand which approaches the subject through the study of energy is one which is very much in vogue to-day, especially with the rapidly growing consumption of fuel oil in Britain and Western Europe. Briefly, it involves projection of an economic series and its energy consumption per unit, a multiplication of the two giving the indicated total use of energy, and finally a distribution of this total amongst competing sources.

A point which must be made here is that it is the job of the forecaster to forecast. It is no good his getting out a lot of figures all hedged around with assumptions, and then passing the buck to somebody else to make the final decision. Every forecaster, perhaps, should have President Truman's motto on his desk—"The buck stops here". For instance, in January 1950, my Company was faced with estimating motor spirit consumption in the U.K. for the years 1950-55. At that time,

petrol rationing was in force, and the vital factor with which the forecaster was faced was when would rationing end? To have put forward an estimate on the basis of the continuation of petrol rationing throughout the period would have been of very little help to those concerned with, say, the planning of the tanker building programme. They would, sooner or later, have had to take a decision, and were probably not those best equipped to do so. In fact, a relaxation of rationing in 1951 and complete derationing in 1952 was assumed. That was wrong, since rationing ended in 1950, but the principle was right—the planners had been given firm figures rather than vague ones.

This leads to an aspect which, while not a technique in itself, has an important bearing upon technique—namely, that it is of the first importance that a forecaster should have an awareness of, and a lively interest in, the economic and political conditions affecting his market. He should know the state of the national income, of employment, of productivity, of exports, and many other kindred problems, so that when called upon to estimate future demand for a given product, the background to his action will be this political, economic, and social knowledge. The estimate made will be in harmony with this knowledge, and his assumptions, if he is called upon to make them explicit, will be consonant with the current scene viewed by an informed and shrewd observer.

Short-Term Estimates

So far, long- or medium-term estimates have been considered but there is also a job which has to be done on short-term forecasting, *i.e.* monthly estimates six, nine, or twelve months ahead. Accurate estimating here is of the highest importance to enable correct decisions to be made in the operational and supply fields, so that not only are the total quantities required available, but are available in the different parts of the market where they will be needed. The general technique of short-term estimating is to establish the seasonal pattern appropriate to the product under review, and then to superimpose this pattern on the trend for the next six, twelve, or eighteen months.

The common technique is to derive the seasonal pattern from a moving average. From a monthly record of deliveries or consumption for, say, five years, the moving average is constructed by averaging successive groups of twelve values and writing the average against the seventh value; or more academically, writing the average of January to December between June and July, the average of February to January between July and August, and the final trend value against July.

Whichever method is adopted, and in practice it makes little difference, trend values are obtained for quite a run of months. The next stage is that the actual values are calculated as percentages of their trend values, and these percentage values are averaged.

Thus, an average seasonal pattern for any given product is obtained. Chart 4 shows the seasonal pattern for derv fuel. The period July 1948—June 1956 was used to establish the pattern, which shows the typical motor fuel summer peak. The trend value for each month of the ensuing year being given from the long-term estimates in current use, expected values can be calculated by applying the appropriate seasonal correction factor for each month.

This method of using percentage deviations from trend is believed to be superior to the simpler one of using absolute deviations, *i.e.* actual minus trend in gallons or tons because, with a steadily rising market as there is in so many petroleum

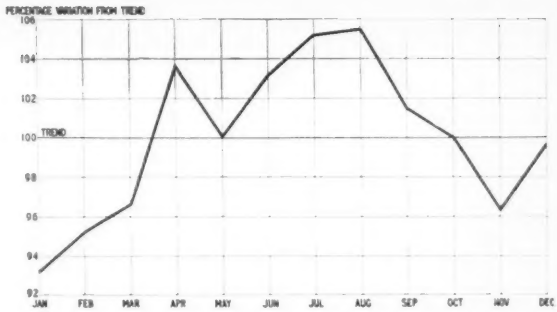


Chart 4. Seasonal pattern of U.K. derv fuel deliveries.

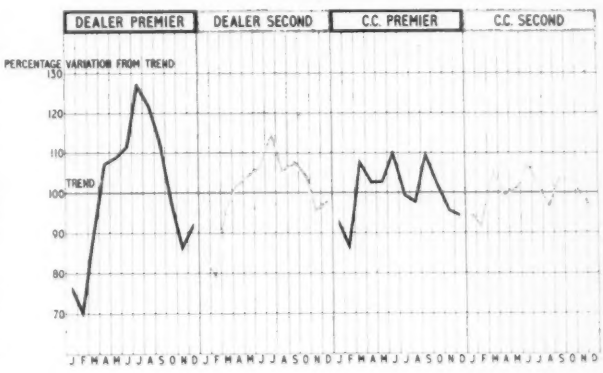
products, the absolute distance between peak and trough becomes ever greater whilst remaining in relative terms about the same. The use of monthly average deviations in absolute terms would, therefore, lead, on a rising market, to underestimation of the extent of the seasonal swing because of the effect on the average of the smaller quantities of the earlier years.

The process briefly described above does, however, need to have some refinements built into it. The first is to take account of the varying number of working days in a particular month from year to year. In fact, the derv fuel example was corrected for working days before the seasonal pattern was calculated. If this is done, care must be taken to add back the working day correction factor, when calculating expected values for the months ahead. The second refinement is mainly concerned with motor spirit forecasts. The British public does a good deal of its motoring at week-ends and this fact, combined with the method of quarterly licensing of motor cars, and the—perhaps—irrational behaviour of the Pascal full moon, makes the movable feast of Easter a time of sharply increased motor spirit demand.

It can make a considerable difference whether the Easter week-end falls in March or April, and by the same token the incidence of Whitsun or August Bank Holiday is also of importance. Last year, for example, the latter was on 1 August, and stocking-up deliveries to dealers were made entirely in July. This year (1956), it was on 6 August and most, if not all, the stocking-up was in August.

When considering seasonal variations, it is often advisable to break the total market into the several component markets, when quite different results in each section might well be

Chart 5. Differing seasonal patterns in the U.K. motor spirit market.


DEALER PREMIER
DEALER SECOND
C.C. PREMIER
C.C. SECOND
PERCENTAGE VARIATION FROM TREND
130
120
110
100
90
80
70
TREND
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

shown. Taking the case of motor spirit, Chart 5 shows that the seasonal pattern is most intense in its peak and trough for dealer premier grade spirit, rather less so for ordinary grades, and still less so for commercial consumer consumption. As has already been seen, the forward estimate for private car consumption shows a very different trend from that of goods vehicle figures, and hence as the dealer weighting becomes more important and the commercial consumer less, it might be predicted with a certain degree of confidence that the seasonal pattern of motor spirit as a whole will become more extreme.

The forecaster would be foolish to rely on one method or technique, however reasonable may appear the answer. He must use different methods of getting at the answer; he must check and cross-check by the methods outlined above as appropriate for the product he is concerned with. Only by doing this, can he define and reduce the zone of uncertainty, otherwise he will find himself at the receiving end of the recent strictures of that *Petroleum Times* character, Uncle Emeritus: "Do you realize that if you assess the annual increase of industrial production of country X between 1956 and 1966 at 3 per cent (compound, of course) it gives so and so, but if you make it 2½ per cent or 3½ per cent, the figure is *enormously* different", and again "What I don't find is any real reason for preferring (say) the 3 per cent or 3½ per cent increase factor to the 4 per cent or the 2 per cent. It's a mere guess, isn't it?" Well, the forecaster's job is to make it as much of a calculation, and as little of a guess as possible. Technique will help him a great deal, but he will learn, and the sooner the better, that technique cannot make his decisions for him, that most estimates will emerge in the form "it's unlikely to be higher than X or lower than Y". At that stage his experience and judgment—call it what you will—must take over.

Discussion

In opening the discussion on the paper, C. P. Dalton, who took the chair, asked whether it was better for the alternative methods of forecasting mentioned to be used by the same people in the same group or by people in semi-independent groups. Mr Barry thought that much depended on the company concerned, but forecasters must be prepared to discuss their results. The advantages of this were obvious.

Apart from the mathematical approach to the problem there were also the views of the marketing men with a lot of background information to be considered, said N. L. Skilling. He asked the author how he dealt with such data and how they were passed to him. Mr Barry thought that petroleum products might be divided into two classes, *i.e.* those whose consumption was affected by external economic circumstances and those for which a market could be created and developed. In the latter case, it was necessary to maintain close contact with the sales organization whose information would help considerably in making forward estimates. A forecaster must always keep records of abnormal events, *e.g.* a spell of fine weather, and the effect on consumption of products.

Asked by F. G. Thackeray whether he thought there was scope in the U.K. for the use of the degree-day system for forecasting winter heating oil demands, Mr Barry said he felt that there was an appreciable scope for its use. This sort of calculation was fairly accurate provided there were no excessive drops in temperature from the normal. The main difficulty was that next week's temperature was not known and short-term estimates could only be made on normal temperatures. In the U.S.A., the system is used mainly on a day-to-day basis.

Mr Thackeray said he believed that the API held out some hope of being able in a few year's time to get comparatively long-range forecasts on temperature. S. D. Colwell thought that the degree-day system had potential operational dangers. His own philosophy as an operations man was opposed to providing reserves of men and vehicles and he preferred to have reserve storage and stocks. With this Mr Barry agreed.

Asked by J. H. M. Clark whether he had any experience in the movement of economic activities in cycles, Mr Barry said that violent trade cycles seemed to be a thing of the past.

M. E. Hubbard hoped that the author would have said how guesswork in estimating could be reduced, but he gathered that it was necessary to guess a bit more. His Company had examined some relevant factors, the first of which was the number of coal-miners in Europe willing to work underground in a few years. The second was the chance of any Finance Minister changing the road fuel tax.

In the case of the swing from gasoline to diesel fuel for commercial vehicles in various European countries, analysis showed that, on tax structure and basic fuel price, never less than 50 per cent of the saving to the diesel operator was due to the lower tax paid in comparison with the gasoline vehicle. In the extreme case of Denmark, the saving due to tax was 80 per cent.

Another fundamental complication was due to the fact that before the last war, the oil industry outside the U.S.A. served only those users who required liquid fuel. To-day there was a world shortage of solid fuels, said Mr Hubbard, and their price had increased faster than that of oil. To estimate the overall oil demand through the energy approach indicated the demand if all the coal mined was effectively used, but coal costs had risen so rapidly that Europe's deficit, imported from the U.S.A., cost half as much again as coal. Some governments might protect their coal industry, whilst others put the accent on economics and the use of the cheapest form of energy. A nice problem for guessing.

Replying to Mr Hubbard, the author said that until about a year or so ago only certain uses of oil were justified economically on existing coal prices. In estimating fuel oil demand, his Company considered past trends of various end uses and applied the coal:oil parity. Thus, the coal:oil parity for steam-raising for electricity generation was 1·5:1; converted coal-fired boilers, 1·8:1; open-hearth steel furnaces, 2-2·2:1; and for some metallurgical furnaces, as much as 3:1 or even higher. At that time, the price parity was 2·2:1. Then it had to be decided whether it was reasonable to assume that by 1957 fuel oil uses with a technical parity of only 1·8:1 would then be on a price level of parity.

Asked by M. D. Gellard whether the author would comment on the inclusion of an economic forecast in short-term forecasting as well, Mr Barry said that exports, unemployment, and suchlike were all factors of which one should be aware. He agreed entirely that they must be kept constantly in mind. His long-term forecasts on motor spirit were based on a continuing growth in national income, in accordance with the Chancellor of the Exchequer's remarks on the basis of doubling the standard of living in a certain period. They were for five years only but he would not like to project those figures through to, say, 1975 without seeing the implications of consumption arrived at for that year.

C. I. Kelly said that when forecasting car populations, account must be taken of the ratio of old to new cars, and Mr Barry agreed that that was an important factor. Before the war, the average private car used over 300 gallons per annum; in 1955 it was about 260 gallons per car. To project ahead such a trend, say, to 1961, an endeavour had been made to classify vehicles by age groups. Two trends had been noted in new cars in recent years. Before the war, the trend was for smaller cars because of the horsepower tax. When the tax was changed to a flat rate one could have got bigger engines with larger gasoline consumption but due to economic pressure the makers have now gone back to small cars with low gasoline consumption. Another reason for the increase in small cars is that about a million cars are now owned by people in the £500 to £800 per year income group. As cars move into that group there would be a tendency for them to be used less.

Lord Geddes,
President

IP Council and Officers

1957-8

At the Annual General Meeting of the Institute on 24 April 1957 the Rt Hon Lord Geddes was unanimously re-elected as President for the Session 1957-8.

At the same meeting H. Hyams was, without dissent, elected a vice-president in place of Professor Frank Morton, who retired after serving the three-year period for which he was elected in 1954. Also, one new Member of Council, Dr K. E. W. Ridler, was declared elected.

This is Mr Hyams' third term as vice-president, he having served in that capacity during 1948-50 and 1952-5. A few months ago Mr Hyams was awarded the Eastlake Medal for long and meritorious service to the Institute and, in making the presentation on 3 October 1956, the president paid a special tribute to the services which Mr Hyams had given in the field of the measurement of bulk quantities of petroleum and in the cause of international co-operation in testing method standardization. As a member of Council since 1944 he had also served on many IP Committees and sub-Committees.

H. Hyams,
Vice-President

Council

Professor F. Morton, retiring vice-president, and W. S. Ault and D. L. Samuel, retiring members of Council, were all re-elected to the Council as the result of the Ballot. Also as the result of the Ballot, K. E. W. Ridler, Ph.D., F.Inst.Pet., was elected to the Council.

Dr Ridler graduated with 1st class honours in Physics from Bristol University in 1932. After carrying out some research in the Physics Department of that University he joined the Department of Physical Chemistry at Cambridge. There he undertook further research under Dr F. P. Bowden and as a result was awarded his Ph.D.

From 1937 until the outbreak of the second world war he was at the Royal Aircraft Establishment, Farnborough. During the war years Dr Ridler was with the Ministry of Aircraft Production and ultimately became assistant director, Research and Development, Engine Fuels and Lubricants.

The war over, Dr Ridler joined The British Petroleum Company (then Anglo-Iranian Oil Company) early in 1946 and, after training, was appointed to originate and develop a Marketing Technical Services Branch. That post he still holds.

Ex-Officio Members

The following were elected as ex-officio members of Council: S. A. Berridge, A. S. Brooman, A. Chatting, J. C. Jewell, L. S. Thornes, and J. C. Wood-Mallock.

Honorary Officers

G. H. Coxon was unanimously re-elected as Honorary Treasurer, and C. Chilvers as Honorary Secretary.

Dr K. E. W. Ridler
Member of Council.

Around the Branches

BAHRAIN, ESSEX, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Essex Branch

The first Annual General Meeting of this newly-formed Branch was held on 22 February and 165 members were present. In his report, which covered the period 7 November 1956 to 19 February 1957, the honorary secretary, E. Bowes, announced that total membership on the latter date was 321, which included 54 corporate members of the IP. In the election for the new committee polling had been heavy and the Branch could take pride in the fact that 80 per cent of its members had voted. The honorary treasurer, L. T. Hogg, then presented the accounts. Both the report and the accounts were adopted unanimously.

As the result of the election, the committee for 1957-58 is as follows :

Chairman	D. H. Tullis
Deputy chairman	E. G. Hannah
Hon secretary	E. Bowes
Hon treasurer	L. T. Hogg
Members	B. R. Fraser*
	R. S. Phillips*
	T. Latta†
	N. R. Miller†
	E. Murray†

*Corporate members
†Non-corporate members

R. H. Poppy and J. Little were elected as auditors, and it was agreed that the model rules be adopted subject to modification necessary to fit them to the Essex Branch.

Safety Contest

B. R. Fraser said that whilst safety was built into industrial plants with a great deal of care, there would always be the important human factor. In the Socony-Mobil Group a safety contest had been in operation for some time. He suggested that a Safety Contest with an annual award should be organized in the U.K. and asked the Branch to take the responsibility of placing the proposal before the IP. The directors of the Mobil Oil Company Ltd were willing to donate a National Safety Trophy. The chairman thought the idea was a new one in the U.K. and said that the Committee would consider it and put it forward.

This concluded the A.G.M.

Films

The chairman then called upon H. L. Fountain to introduce two films—*Down a Long Way* and 10,000 *Feet Deep*, both of which were concerned with drilling for oil. Mr Fountain gave a brief historical survey of well drilling and mentioned that the Chinese were believed to have started the technique as far back as 212 B.C. They are reported to have reached depths of 3000 feet in drilling for brine.

After the films had been shown there was an entertaining and informative discussion on the subject. After a short interval the film *Rig 20* was shown.

Scottish Branch

A meeting of the Branch was held in the Recreation Hall, BP Refinery (Grangemouth) Ltd, on 21 March, when J. M. Caldwell (chairman) announced the names of the following officials who had been appointed (at a previous committee meeting) for the year 1957-58:—

J. M. Caldwell, J.P. (chairman), H. B. Nisbet (vice-chairman), Dr G. H. Smith, M.C. (hon. treasurer), Dr W. B. Peutherer (hon. recorder), and Wm Stirling (hon. secretary).

The chairman then introduced G. F. J. Murray who presented a paper by himself and D. F. Tompkins on "Petroleum Fuels for Domestic Heating and Lighting". This paper was originally presented to the Institute on 11 January 1956 and subsequently to the South Wales Branch on 2 November 1956, as reported in these columns in February (p.42).

South-Eastern Branch

A joint meeting of the Branch with the Kent Sub-Branch of the Royal Institute of Chemistry, who acted as host, was held at the Medway College of Technology on 21 March, when Dr S. F. Birch, of The British Petroleum Company, presented a paper on "Petrochemicals."

Dr Birch first traced the growth of the petroleum-chemical industry from its beginnings, shortly after the first world war, to its present enormous proportions. He pointed out that, due to the lack of indigenous crude oil, the industry in Britain got away to a slow start, but since the last war it had made great strides.

Owing to the complexity of the subject and the limited time at his disposal, he then dealt in more detail with only a few of the petroleum-chemical derivatives of ethylene and propylene. Among the chemicals whose histories, preparative processes, and uses he mentioned were ethylene oxide, glycols, alcohols, glycerine, ethanolamines, aldehydes, and detergents, as well as plastics and synthetic fibres such as PVC, polythene, Terylene, and nylon.

Stressing the importance of research and development, he said that the present vast petroleum-chemical industry had grown in two main ways. In the first place, the petroleum chemist set out to make, more cheaply and more efficiently, substances such as ethanol and benzene, which were already being produced in large quantities and for which a market was readily available. Secondly, the oil companies' chemists, in conjunction with those in other branches of the chemical industry, applied their

Petroleum at the Science Museum

The catalytic cracking model which has now been placed in the petroleum exhibition sponsored by the Institute in the Science Museum, London. As shown, the functions and operation of the process are simply explained.

AROUND THE BRANCHES (*continued from preceding page*)

efforts and ingenuity to developing new uses for the apparently waste by-products of refinery and petroleum-chemical processes. An example of this type, he said, was in fact, the whole petroleum-chemical industry based on ethylene and propylene, which were originally waste products of the cracking processes used to produce high quality motor spirit components.

After a number of questions from some of the 87 members and friends present, a vote of thanks to Dr Birch was carried with acclamation. Representatives of both Institutes also expressed thanks to the Kent Education Committee and the authorities of the Medway College of Technology for their co-operation and assistance.

Stanlow Branch

The Annual General Meeting of the Branch was held at the Grosvenor Hotel, Chester, on 16 January. This meeting was followed by a film show, when 64 members and their guests saw five films, as follows:—

(1) *Down a Long Way*
(2) *The Rival World*
(3) *Speed the Plough*
(4) *Highways for Tomorrow*
(5) *Beneath the Flames*

The first three films were loaned by the Petroleum Films Bureau, the fourth by Esso Petroleum Co Ltd, and the fifth by Mobil Oil Co Ltd.

Nuclear Power Production

On 21 February, the Branch held a joint meeting with the N.W. Branch of the Institute of Fuel. On this occasion, V. Biske (chairman) introduced F. M Greenlees, of the U.K. Atomic Energy Authority, who presented a paper on "Nuclear Reactors for Power Production".

Mr Greenlees first dealt briefly with the basic principles of the reactions involved in the atomic piles, and then went on to describe in more detail the Harwell, Winscale, and Calder Hall projects.

Special problems in the field of power from atomic energy were then considered, these being the metallurgical considerations, safety, electrical aspects, control features, and so on.

He concluded with a short survey of future prospects in Britain and the type of units which were envisaged.

A discussion was opened by Dr R. Irving (Thornton Research Centre), and finally the author of the paper was accorded a vote of thanks, proposed by H. L. Trafford (Institute of Fuel).

Personal Notes

Sir Leonard Sinclair is to relinquish his position of managing director, Esso Petroleum Co Ltd on 31 May, after the Annual General Meeting. He will continue as chairman of the Board. **H. C. Tett** will become the chief executive from that date and **R. J. Pinder** will continue as a managing director.

A. L. King, A.C.C.A., F.R.S.S., M.Inst.Pet until., recently general manager, Administration, has been appointed general manager, Sales, of Shell-Mex and BP Ltd, following the retirement of **A. M. Mackintosh** from this post.

Mr Mackintosh has taken over co-ordinating duties within the Shell-Mex and BP group of companies.

A. L. King (left).

A. M. Mackintosh (below)

Shell-Mex and BP photographs

R. Catherall, B.Sc.Tech., a senior scientist in charge of the design of Solartron electronic instruments, has been appointed a director of Solartron Research and Development Ltd. On 26 March he departed for the United States on a two months' visit to the Consolidated Electrodynamic Corp., Pasadena, California, where he will study American techniques in data processing.

F. A. Jackman, who was elected to the Board of Carless, Capel & Leonard Ltd in January, has since been appointed assistant managing director.

J. A. Lumsden, M.B.E., of Maclay Murray & Spens, Glasgow, solicitors, has been appointed a director of G. & J. Weir Ltd.

G. Edwards, the Welsh International footballer, who joined Mobil Oil Company in 1951, has been appointed automotive manager of the South Wales District in place of **M. E. Morgan,** who has decided to emigrate to Canada.

F. H. Roberts, M.I.E.(Australia), F.Inst.F., has been appointed a director and chief engineer of John Thompson (Australia) Pty Ltd, a member company of the John Thompson Group. Mr Roberts has played an important part in the development of power station plant using Victorian brown coal and New South Wales black coal as briquettes.

L. M. Broadway has been elected deputy chairman to the Board of C. C. Wakefield & Co Ltd. He will hold this office in conjunction with his position as managing director.

Mr Broadway, who runs the expanding Wakefield Group of 21 Companies, was promoted to the Board in 1947 and has been managing director since 1954.

It is with regret that we announce the death of **Walter Harold Senneck,** a director of C. C. Wakefield & Co Ltd, which occurred while he was returning from a business trip to Australia on 23 March. Mr Senneck, who was 66 years of age, joined the Company 50 years ago and was appointed a director in January 1938. Six months later he was made joint managing director and held this office until 1951. Since that date he continued to serve on the Board until his death.

ESSO RESEARCH AND ENGINEERING APPOINTMENTS

Dr William J. Sparks, who has just been appointed to the Board of Esso Research and Engineering Co. in a new position of Scientific Advisor, is a co-inventor of butyl synthetic rubber. He has been director of the Chemicals Research Division since 1946 and holds more than 100 patents. The Company announced that this post was created as part of its long-standing policy of "according recognition and prestige to the abilities and achievements of individual scientists and engineers".

Dr Robert W. Krebs, who has been associate director of the Baton Rouge, La., Esso Research Laboratories, has succeeded Dr Sparks as director of the Chemicals Research Division, Esso Research and Engineering Co. Dr Krebs has made major contributions to the development of fluid catalytic cracking, butyl synthetic rubber, hydrocarbon synthesis, and the fluid coking process.

Dr Fred W. Banes, who has been acting associate director of the Chemicals Research Division, Esso Research and Engineering Co., has been appointed associate director. He has worked on several phases of high polymer chemistry, separations of hydrocarbons, and the development of petroleum chemical products and processes.

Dr Floyd L. Miller has been appointed by Esso Research and Engineering Co. as Co-ordinator of Legal, Patent, and Information activities. He had been deputy co-ordinator since 1954. He joined the company, scientific affiliate of Standard Oil Company (New Jersey), in 1930, and his previous positions included that of director of the Products Research Division.

New Directors recently elected by Esso Research and Engineering Company from Standard Oil Company (New Jersey) affiliates are: **L. J. Brewer** (*president, Esso Standard S.A.*); **M. L. Haider** (*president, International Petroleum Corp.*); **C. G. Herrington** (*vice president,Carter Oil Co.*); **Charles Leet** (*director, Creole Petroleum Corp.*); and **Carl O. Tongberg** (*vice-president, Carter Oil Co.*).

Notes of the Month

Plan for £8 million Refinery in Iran

C. J. Wright, British oil consultant to the National Iranian Oil Company, recently left by air for Teheran to plan an £8 million project for an oil gathering system and an oil refinery to be built in North Iran. The refinery is expected to have an annual output of some two million tons.

Oil Find in France

The Société Nationale des Pétroles d'Aquitaine, in which BP has an interest through its French associated company (Société Française des Pétroles BP), has announced the discovery of oil at the second well drilled at Clermont, Landes, half way between Puyoo and Dax. On test, the well produced about 300 gallons of oil in just over one hour. It is planned to drill further test wells in the area.

Aero Surveys in Antarctica

Hunting Aerosurveys report that considerable progress has been made in the aerial survey of the Graham Land sector of the Antarctic Continent. This survey is being made on behalf of the Governor of the Falkland Islands and already 40,000 square miles have been photographed by their two Cango flying boats. Inspection of the photographs shows that many islands and some of the coast of Graham Land itself are different from what had been thought before.

The Pipeline Industries Guild

The first meeting of the Pipeline Industries Guild was held at the Westminster Arms, Marsham Street, London, S.W.1. on 13 March when a good attendance saw a film *Greater than Gold*. The film dealt with the laying of a 30-inch steel pipeline for water at Colorado Springs. After the film a Brains Trust was held, and many interesting questions were raised and discussed.

At the second meeting, which was held on 6 April under the chairmanship of T. Mervyn Jones, chairman of the Wales Gas Board, an attendance of over 200 saw two films *Pipeline for Wales* and *Pipeline Across Wales*. These films were made respectively by Fibreglass Ltd, and by Costain-John Brown Ltd. After the films a general discussion took place on the main subject of gas pipelines. Question and answer followed in rapid succession and the meeting was voted a big success.

The next meeting of the Guild will be on 9 October and details will be announced in due course.

Zanzibar Well Completed

The BP-Shell Petroleum Development Company of Zanzibar Ltd has announced that the drilling of its Zanzibar deep test well has been completed at a depth of 14,281 feet.

No oil has been discovered, the Company stated, but the geological information obtained from it has materially added to existing knowledge. Pending further study of the geological data from this well and regional studies on the mainland, the equipment will be thoroughly overhauled in Zanzibar. It has not yet been decided where the next deep test well will be drilled.

Nuclear Research Centre for New Jersey

Socony Mobil Oil Company Inc. announces that construction of a nuclear research centre, which will be used for studying the application of radiation to petroleum technology, is expected to begin this summer on a 315-acre site near Princeton, New Jersey.

This new centre will be operated as a subdivision of the Socony Mobil Research and Development Laboratory at Paulsboro, N.J., and will contain a 2 million-electron-volt Van de Graaf accelerator, a "hot" laboratory equipped for manipulation of fission-waste radio-isotopes, and "counting" laboratories for assaying radioactive materials.

New Aircraft Safety Device

A new detector for checking the percentage of undissolved water in aviation turbine fuel has been developed at Thornton Research Centre.

It is being put into service at all airports throughout the world at which Shell's aviation turbine fuel is supplied, and, in the interest of aviation safety, it will be made available without patent royalty to all who wish to use it.

The manufacturers claim that it is capable of detecting the presence of as little as 0·003 per cent water and, during extensive field trials, has proved reliable, quick, and easy to use.

BP Acquires 50 Canadian Service Stations

A new step towards implementing the recently announced plans to market BP products in Canada has been completed. This is the purchase from Odilon Chevrier of Chicotoumi, Quebec, of 50 service stations, which will begin marketing under the BP sign on 1 May. The deal involves the acquisition of two companies, the Lake St. John Distributing Company and the Corporation Saguenayenne Ltee, as well as a number of stations hitherto personally owned by Mr Chevrier. These two companies thus become subsidiaries of BP (Canada) Ltd. The service stations are in north-eastern Quebec.

New Tankers for BP's French Associate

Société Maritime des Pétroles BP, shipping subsidiary of BP's French associate, Société Française des Pétroles BP, has ordered three new tankers from Ateliers et Chantiers de France at Dunkirk. Two will be of 47,670 tons and one of 68,500 tons. Delivery will be in 1960, 1961, and 1963. Since the end of the war, when the fleet of Société Maritime des Pétroles BP amounted to no more than 24,000 deadweight tons, a considerable programme of expansion has been carried out and the fleet now consists of 10 ships totalling 210,000 deadweight tons, three of which are 33,000-tonners launched in 1955 and 1956. Another 33,000-tonner will be launched at Dunkirk this year.

Progress at Kent Refinery

Work is going ahead on the project to increase the annual processing capacity of BP's Kent Refinery on the Isle of Grain from 4,500,000 tons to about 7 million tons. This expansion, which will cost some £26 million, is due to be completed in 1958 but the increased crude oil throughput should be available by December this year. The driving of piles for the various units and the jetties is almost completed — nearly seven and a half thousand piles having been driven to a total length of 283,000 ft.

Esso Petroleum Expansion

Esso Petroleum Company Ltd announces that it is shortly to commence a £1½ million expansion scheme at Avonmouth on a new 30-acre site at Holesmouth to be acquired from the Port of Bristol Authority. On this site a new storage terminal will be erected and connected by pipeline with the Company's existing ocean terminal at Avonmouth.

The purpose of this expansion is to increase storage capacity for fuel oil for industry, and other products, to enable the company to keep pace with the expanding demand for petroleum products in line with the nation's rising energy consumption. The new installation will contain all the latest developments in petroleum storage and handling.

It will be recalled that Avonmouth has been a major importing centre for petroleum products since the earliest days of the petroleum industry in the U.K., and Esso Petroleum Company (then known as the Anglo-American Oil Company) was the first company to construct bulk storage for oil in the area. Their original bulk storage depot at Broad Pill was erected in 1892.

Women Drivers Compete in Mobilgas Economy Run

For the first time women drivers were allowed to compete in the American 1957 Mobilgas Economy Run, which covered a route from Los Angeles to Sun Valley, Idaho.

This motoring competition subjects the latest models to a tough four-day drive through stop-and-go traffic in towns as well as long stretches of open road and country.

The field was divided into four classes from the American motor car industry's traditional price classifications: low, low-medium, upper-medium, and high price.

The competition was again won by Mel Alsbury, jnr, in his Chrysler Imperial Crown. He averaged 20·95 m.p.g., and, on the ton–mile formula, attained 64·52 ton miles per U.S. gallon.

New Submarine Fuel

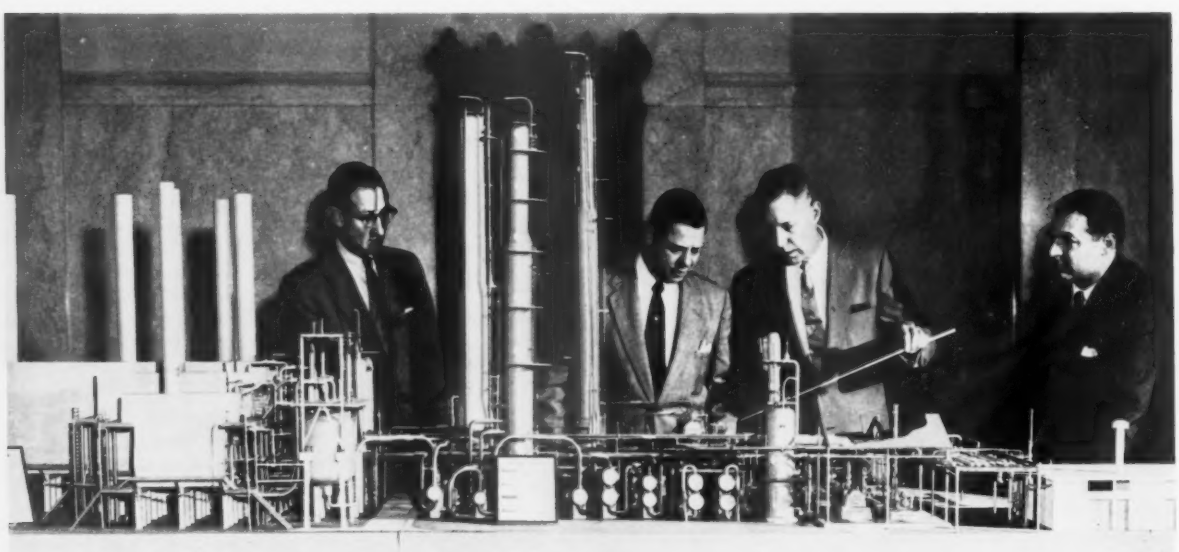
During March H.M. Submarine *Explorer* paid a six-day visit to London and berthed in the West India Dock. This vessel is the first of the experimental high-speed submarines, her main propelling machinery consisting of turbines supplied with steam and carbon dioxide produced by burning diesel oil in an atmosphere of steam and oxygen formed by the decomposition of H.T.P. (high test peroxide).

In operation, a triple pump supplies H.T.P., special oil fuel, and feed water through a proportioning device to a "three-cam" valve. This valve first allows H.T.P. to enter the catalyst chamber, where it decomposes, and the resultant steam–oxygen mixture passes to the combustion chamber. The valve then passes respectively water and fuel to the combustion chamber, the water cooling the chamber and reducing the gas outlet temperature to that required. The steam–carbon dioxide mixture from the combustion chamber passes to the turbine through a changeover valve.

Explorer is thus able to develop full power when submerged and independent of atmospheric oxygen. Power for surface passages is provided by diesel engines, and for low speeds when submerged by main motors battery-driven.

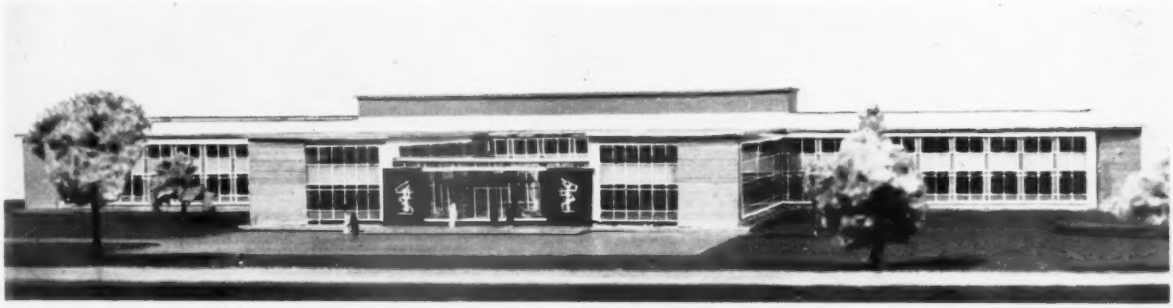
An Outsize in Models

A ¾-inch scale model of a Kellogg catalytic reforming unit, complete from ladder rungs to towers, was recently on show in the New York College of Engineering. Its size is 12 × 55 × 5 feet and it was made in the Company's own model shop. The actual unit is at the Pure Oil Company's refinery in Lemont, Illinois, where the model is to be used during construction and operation. Later it will be used for training operators and in the safety-first programme. Similar plants are under construction for BP at Kent; for Société des Pétroles BP at Dunkirk, France; for Société Industrielle Belge des Pétroles, at Antwerp, Belgium; and for BP at Kwinana, Australia.



Examining the scale model are (left to right): *P. A. Maschwitz, process department, The Pure Oil Company; H. Kershaw, supervisor of plant layout, The M. W. Kellogg Company; Dr W. F. Krause, technical manager of Pure Oil's Lamont, Illinois, refinery; and Dr Charles J. Marsel, associate professor of chemical engineering, New York University College of Engineering.*

Esso Research Expansion at Abingdon



The new main research laboratories which Esso Research Ltd are constructing at their Abingdon, Berkshire, research station are rapidly taking shape. This picture of a model indicates the pleasing appearance of the new home for the laboratories and offices.

Dry Well at Oloibiri

The latest appraisal well to be drilled by Shell-BP Development Company of Nigeria into the Oloibiri structure has been abandoned as a dry hole. Drilling was stopped at 10,500 ft after formations which had been found to be oil-bearing in previous wells had proved negative. The well has now been plugged with cement and abandoned.

The failure of this well appears to have established a southern limit to the field and the Ideal 100 drilling rig is now being moved to the eastern part of the structure, where the next appraisal well, Oloibiri No. 5, will be drilled just under two miles south-east of Oloibiri No. 3.

The three previous wells drilled at Oloibiri have all found oil, and production tests are due to begin about the middle of this year.

Drilling Barge for Persian Gulf

The launching of the German-built drilling barge, for the first underwater deep test well to be undertaken by Abu Dhabi Marine Areas Ltd in the Persian Gulf, was successfully completed on 11 April.

After fitting out, it will undergo trials and, subsequently, will be towed to the Persian Gulf site, where drilling is due to begin early next year. The barge will mount a drilling rig capable of reaching a depth of 15,000 feet, and will be raised above the water by means of four retractable legs resting on the sea bed 50 feet below the surface. There will be accommodation on board for about 50 men.

Meanwhile, as reported in these columns recently, good progress is being made in constructing the base camp on Das Island, 20 miles from the test well site.

Australian Oil Search

In his annual statement, the chairman of Interstate Oil Ltd refers to the work carried out during 1956 in the various areas held by Frome-Broken Hill Co Pty Ltd, and Frome-Lakes Pty Ltd. In the Gippsland area of Victoria, following information gained from Darriman No. 1 well, five relatively shallow wells were drilled in the latter part of 1956 and early 1957. No oil and gas was encountered in any well, and drilling has been suspended, although the question of further testing is still under review.

In South Australia and other parts of Victoria, geological and geophysical work has been carried out, and gravity surveys have also been carried out in the Gulf of Carpentaria. He concludes that the work has added to the knowledge of the sedimentary basins but further investigation will be required before any conclusive evaluation can be made of the prospects of a commercial source of oil.

London Computer Group

Following a demand from many centres, the London Computer Group announces that it has completed arrangements to assist in the formation of other similar groups of members outside the London area. These groups will together act in association with each other, sharing common services, yet retaining their local autonomy and individuality.

The Group also announces that it is setting up a Research Sub-Committee to report on specific problems addressed to it from time to time, and in particular to maintain the annual survey of computers and electronic data processing installations operating and planned in Britain.

Reformed on a permanent basis in January, after consultation with its members, which are now approaching the 500 mark, the Group was recently completing arrangements for its two-day Autumn Convention and other activities for the coming year.

A copy of the report covering the reorganization of the Group, the programme for 1957, and details of subscription are available on application to: the joint hon. secretaries, London Computer Group, 29 Bury Street, St. James's, London, S.W.1.

Finance for BP Tankers

Arrangements which will provide £40 million to finance new tankers for the BP Tanker Company were announced recently.

A new company, Tanker Charter Company Ltd, has been formed with a nominal capital, which will be owned equally by the London merchant banking firm of Robert Fleming & Co Ltd and by Ship Mortgage Finance Company Ltd. The Tanker Charter Company will raise £40 million of loans on the security of new tankers being built to the order of BP Tanker Company and which it will purchase following completion over the next three years. These tankers will be chartered to the BP Tanker Company by the Tanker Charter Company on terms calculated to cover loan interest and retirement over 23 years, at the end of which period the tankers will revert to the BP Tanker Company.

Of this £40 million a syndicate of banks headed by the

National Provincial Bank has agreed to advance £15 million. In addition, there have been placed with institutional investors £5 million of a medium term Loan Stock with a life of 9-12 years and £20 million of Stock with a life of 13-23 years.

Assam's Deepest Producer

With the finding of oil at 11,292 feet, No. 2 well of the Assam Oil Company at Moran becomes the deepest producer in the India-Burma and Pakistan sub-continent. Preparations are also being made to ascertain whether a higher sand at about 10,780 feet is also oil-bearing.

It is recalled in *Digboi Batori* for March that the first well at Moran reached a depth of 13,739 feet, and is still the deepest well.

Drilling of No. 2 well commenced in December last and was completed on 2 February at a total depth of 12,065 feet. Preparations for a third well are in progress and site clearance at the location for No. 4 has been completed.

In the Nahorkatiya area, well No. 23 completed drilling on 9 January at 10,122 feet and also found oil.

Borneo Oil Company Transfer

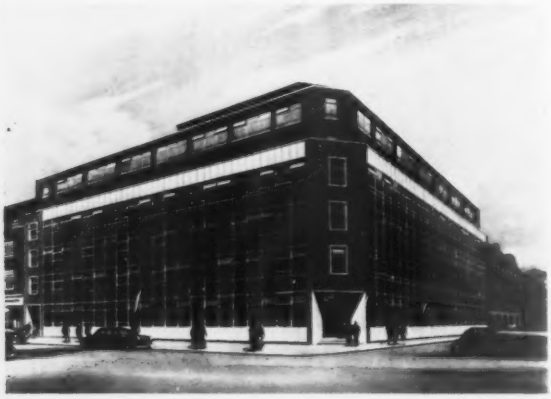
Brunei Shell Petroleum Company Ltd, the new Shell Group Company registered in Brunei on 1 January, is now working on its own account and the British Malayan Petroleum Company Ltd, registered in the United Kingdom, will go into liquidation. In effect operations will continue unchanged.

The directors of Brunei Shell are the same as those of the British Malayan Petroleum Company, namely R. E. Hales, C.B.E. (managing director), J. L. Winter, C. E Thiebaud, C. N. Chater, and F. G. West.

The Company estimates it will drill thirty wells this year compared with 36 drilled by BMPC last year. Current average daily production of the Seria oilfield is 112,000 barrels. During the life of this field 450 wells have been drilled, of which 295 are producers. Five drilling strings are at present in use and there is one repair string.

During 1957 the Company has budgeted to spend about £3½ million on its exploration and drilling programmes and a further £2 million on capital construction.

New London Home for Badger



This five-storey building, 20 Red Lion Street, London, W.C.1, is the new home of E. B. Badger & Sons Ltd. It provides central accommodation for the entire staff from the Aldwych and Battersea offices, and has space for expansion.

Danish LPG Plant

A BP photograph

With a capacity of about 700,000 cylinder fillings a year, this LPG filling plant at Fredericia, Denmark, is one of the largest and most up-to-date in the country. Filling is by an electrically-controlled automatic process and the plan is operated by BP Olie-Kompagniet A/S.

Royal Visit to the Hunting Group

H.R.H. the Prince Philip, Duke of Edinburgh, visited the Hunting Group's three survey and resources development companies at Elstree on 12 March. Accompanied by Squadron Leader H. Chinnery, His Royal Highness was received by P. Ll. Hunting (Group chairman), C. P. M. Hunting (Company chairman), and F. L. Wills (managing director).

After touring the laboratories of Hunting Aerosurveys Ltd, Prince Philip examined in detail a display of airborne mineral survey equipment used by Hunting Geophysics Ltd and Hunting Technical Services Ltd. The equipment included a magnetometer for subsurface geological structure mapping; an electromagnetic detector, used for the direct detection of conducting sulphide ore bodies; and a scintillation counter, used in surveys for radioactive ores.

Research as an Aid to Science Teaching

Preliminary grants to enable research projects to be undertaken in the science departments have been made by The Shell Petroleum Company Ltd to four public schools.

The shortage of scientists in Britain has been attributed to an insufficient number of the best young scientists being attracted to teaching as a profession. It has been thought that added attraction would be given to a teaching career if a research project could be undertaken as a part-time occupation within the circle of masters and boys specializing in science at individual schools.

In this way, the scope of the scientific interests of the science master would be maintained or widened, and the carrying out of such work in their midst would help to show the senior boys that science is a living thing and not just another text-book subject. It might be possible for senior boys to participate in such research.

In order to put this scheme into practice, Shell appointed members of their technical staff to collaborate with the headmasters of selected schools, and are hopeful that other public schools may be sufficiently interested to approach them.

Mobil Endowment at Ghana University

Sir Arku Karsah, chairman of Ghana University College Council, announced recently that the University had received an offer from Mobil Oil Gold Coast Ltd to endow a chair, to be known as the Mobil Oil Chair of Business Administration. David Balme, principal of the University, added that he and the faculty had examined the offer, had approved it, and would recommend the Council to accept it.

The endowment will provide a Professor of Business Administration from leading American universities each year for a period of 5 years. The professors, who will be selected by the Institute of International Education, will reside at the University and teach a variety of courses on various phases of business management and administration in such fields as industrial organization, financial management and control, business policies, salary administration, and similar subjects.

R. M. Sheridan, manager of Mobil Oil Gold Coast Ltd, has estimated that the cost of the project for salaries and transportation of professors over a 5-year period would amount to approximately £25,000 to £30,000.

Drilling in Canada

The Oil and Gas Journal in its annual survey published in the issue dated 28 January includes the following details of wells completed in Western Canada during 1956:

	Alberta	*Saskatchewan*	*Manitoba*	*British Columbia*	*Total*
Field wells:					
Oil wells ...	1,309	715	192	6	2,222
Gas wells ...	82	9	0	25	116
Dry holes ...	99	71	15	1	186
	1,490	795	207	32	2,524
Wildcat wells:					
Oil wells ...	62	75	3	0	140
Gas wells ...	56	2	0	10	68
Dry holes ...	253	220	42	14	529
	371	297	45	24	737
Footage drilled:					
Field wells ...	7,829,894	3,303,974	446,939	164,072	11,744,879
Wildcat wells ...	2,137,543	1,264,926	132,765	158,454	3,693,688
	9,967,437	4,568,900	579,704	322,526	15,438,567

BP in Antarctica

Motor fuel, aviation spirit, diesel oil, and kerosine for the Commonwealth Trans-Antarctic Expedition were supplied by The British Petroleum Company. They were shipped in the Magga Dan (34,000 *gallons*), *seen* (left) *with her bows high above the ice after unloading, the* Theron (12,800 *gallons*), *and the* Endeavour (36,000 *gallons*).

(Below) *Geoffrey Pratt, a BP geophysicist seconded to the Expedition, attempts a gravity measurement on an iceberg in the Weddell Sea. Penguins are rarely seen at Shackleton and the small party* (below, left) *find the Muskeg and its load of some interest.*

BP photographs

Oil Exploration in the United Kingdom

By **I. GILLESPIE**

This paper was read to a meeting of the IP South-Eastern Branch on 4 September 1956.
Mr Gillespie is with the BP Exploration Company at Eakring.

Before the course taken by the exploration for oil in the United Kingdom can be understood it is necessary to understand the geological principles on which the search for oil is based.

It is generally agreed that petroleum and natural gas are of organic and sedimentary origin and are found occupying the pore space in what are known as reservoir rocks, generally sandstone or limestone. Most oil geologists would subscribe to a three-stage cycle of origin and accumulation such as follows:—

(1) *Origin.* Disseminated organic material, either solid or liquid, is deposited with fine grained muds or clay as these are laid down under water—the majority believe that this was sea water and that the organic material was of marine origin, either animal or vegetable. The organic material was probably transformed into petroleum at this stage, possibly by some bacterial action.

(2) *Primary Migration.* As these water-logged fine muds or clays were buried progressively deeper by succeeding sediments they became more and more compacted and the interstitial water originally present, together with any petroleum formed, was squeezed out into more porous and less compactible beds, the reservoir rocks.

(3) *Secondary Migration and Accumulation.* Once in the reservoir rock the gas, oil, and water which are originally all mixed together, separate out on a gravity basis, the gas and oil migrate to the highest part of the reservoir rock until further migration is blocked and the oil and gas are trapped. Once trapped an accumulation forms and in the traps a three-layered arrangement of gas, oil, and water is commonly found. Frequently, however, depending on the nature of the petroleum, either the gas or oil layer may be absent.

Oil Accumulations

There is no known method of finding oil accumulations directly, either by diviner's wands or by complex Geiger-counter-like instruments. The search for oil is therefore an indirect one, a search for traps in an area containing potential source, reservoir, and cap rocks. Reservoir rocks and cap rocks, beds of fine-grained impermeable rocks overlying the reservoir rocks and thus preventing further migration of the petroleum, can be recognized in the field; source rocks on the other hand cannot. However, there is the vague guide that the probable source rocks are fine-grained and rich in organic material, and, much more valuable, there are frequently surface indications of petroleum in the form of oil and gas seepages, bitumen residues, etc., in potentially petroliferous areas.

Since the traps are the primary object of the search it is worth considering them in more detail. There are three main types:—

(1) *Structural Traps* are those formed when the reservoir rock has been deformed either by folding or faulting or both, in such a way that part of the reservoir rock has been elevated above the remainder, as in anticlines.

(2) *Stratigraphic Traps* are those caused by some up-dip discontinuity of, or in, the reservoir rock; either by it failing completely, by lensing out, or being truncated by an unconformity; or by a change in its porosity characteristics.

(3) *Combination Traps* are those with some of the characteristics of each of the other two and which cannot be classified clearly as one or the other.

Since only structural or partly structural traps have any expression in the surface geology of an area they are the initial object of the search. In general, stratigraphic traps are found either by accident or only after much subsurface geological information has become available as a result of drilling numerous boreholes. Once a suitable structure has been found it is studied in detail to determine the highest point of the structure, the culmination, at the horizon of the potential reservoir rock. On this culmination the test well, or wildcat, is located and drilled. This wildcat well is the ultimate test of the structure and only a well drilled in a suitable position on the trap can reveal whether or not there is an oil or gas accumulation in the structure.

Oil Exploration

In general, an oil exploration programme falls into three parts, as follows:—

(1) The defining of an area which is potentially suitable for the generation and accumulation of petroleum. In unknown territory this means that the general geology has to be studied and mapped before an appraisal of the territory from an oil point of view can be made.

(2) The search for and detailing of a suitable structure in the potentially favourable area.

(3) The siting and drilling of a test well on the culmination of that structure.

In Britain, the surface geology is well known, having been studied and mapped in detail by H.M. Geological Survey, research geologists at the universities, mining companies, and so on. A study of this geological information, which is readily available, makes it possible, from the oil point of view, to ignore and write off much of the country, either because the rocks are of igneous rather than sedimentary origin or, if of sedimentary origin, have later been altered in character and so lack porosity or permeability,

or have been so shattered by deformation that any petroleum they may once have contained has long since been dissipated. For such reasons, the whole of Scotland other than the eastern part of the Midland Valley, the Lake District, Wales, Devon, and Cornwall can be dismissed from consideration. Within the remainder of the country the rocks of three systems, the Carboniferous, the Permian, and the Jurassic offer many surface or underground indications of oil and gas and exploration activity has been confined to the search for oil in rocks of these systems.

Of these the Carboniferous prospects are the most favourable and exploration has tended to be concentrated on them, particularly in the East Midlands where producing oilfields have been found.

The geology of this area is fairly straightforward. The oldest rocks to be considered are the Lower Carboniferous limestones. These were laid down horizontally over the region when it was covered by the sea. They are for the most part grey, massive limestones of marine origin, frequently rich in fossils. They are followed by the Upper Carboniferous Millstone Grits, which consist of alternating beds of shale, frequently with marine fossils, and thick coarse deltaic sandstones. This alternation results from the intermittent advances and retreats of the delta of a large river coming from the north-east into the sea area where the Lower Carboniferous limestones were laid down. The Millstone Grits are followed in turn by the coal measures, also of Upper Carboniferous age. The coal measures consist of a repetition of the following cycle of deposits:—

Marine band, etc.
Coal
Fireclay
Sandstone
Non-Marine mudstone
Marine band

This cycle is interpreted to have resulted from the conditions under which the coal measures were laid down. With time, the Pennine Delta of the Millstone Grits silted up, sand and mud banks formed, and on these swampy flats, lying virtually at sea level, vegetation grew. The upper layer of the swamp became transformed into a soil, and as the vegetation died and grew a layer of peat would form. Periodically, these swamps were invaded by the sea, the vegetation was killed and buried under marine muds and clays, and as the area became silted up by non-marine muds and sands vegetation again appeared. On burial, these deposits of peat, earth, sand, mud, and marine mud were transformed into coal, fireclay sandstone, shale, and so on.

At the end of the Carboniferous these predominantly horizontal strata were folded into a series of anticlines and synclines and the whole area elevated to become land. Erosion had attacked this land and reduced it almost to a plain when the Permian sea invaded the country from the east. The limestone laid down under this sea was deposited horizontally and with marked unconformity across the truncated structures of the underlying Carboniferous rocks. In the East Midlands area, there are two major Permian limestones separated by a development of deep red mudstones and siltstones. These red beds indicate that at this time the climate was dry and arid rather like that of the deserts in the world to-day. There is confirmation of this in that N.E. Yorkshire, at this time an area of the major Permian Sea, was for one reason or another cut off from the parent ocean and evaporated to dryness, leaving behind as deposits of rock salt all the dissolved salts that it contained. Evaporites on this scale can only occur in hot, arid climatic conditions.

At the end of the Permian, the sea again retreated and the succeeding Triassic deposits are of continental origin and were laid down on the land surface. Triassic rocks are deep red in colour; those of the Bunter, the lower subdivision, are coarse sandstones, some of which are true dune sands, and those of the Keuper are finer grained siltstones and mudstones. At the end of the Triassic, the land was again almost a plain when the sea again transgressed over this area. In this sea the marine Jurassic and Cretaceous rocks were laid down. Sometime after the end of the Cretaceous, the whole country was again deformed and the Permian and all later strata were distorted and uplifted. These rocks were folded in N.E. Yorkshire and South England but in the East Midlands they were merely tilted to the east. This elevated land mass was subjected to a period of erosion which has continued more or less uninterruptedly to the present day. In the East Midlands, the Permian and later cover has been stripped off the Pennine area and the exposed Nottinghamshire–Yorkshire coalfield. East of the exposed coalfield mining proved the continuation of the Carboniferous rocks under the unconformable cover of the Permian and later beds.

In the period 1918-22 the Ministry of Munitions started the first organized search for oil in Britain. A team of American experts was employed and, impressed by the number of oil indications in the area, they located and drilled some nine holes on surface anticlines in the Carboniferous of the Midlands. Of these only Hardstoft No. 1 in Derbyshire was a producer. It produced a little oil from the Carboniferous limestone.

Active exploration then ceased until after 1934, when the Petroleum Act was passed. This act invested the petroleum rights in the crown. Further exploration in Britain, a geologically complex area, was encouraged also by improved drilling and geophysical exploration techniques and equipment and by a greater understanding of the geology of petroleum.

The East Midland Field

In the 1930s, D'Arcy Exploration Company (now BP Exploration Co), the subsidiary company of Anglo-Iranian Oil Company (now British Petroleum Company) engaged on exploration, among others took out exploration licences covering large areas of Britain. One of the areas covered was the East Midands. The justification for this again lay in the numerous seepages etc., and also in the oil production at Hardstoft. The surface anticlines in the Coal Measures had not proved very fruitful so geophysical seismic surveys were made over the concealed coalfield and areas eastward to locate structures in the Carboniferous under the Permian unconformity.

Workings at Bilsthorpe Colliery indicated that there was probably an anticline near Eakring. This structure was confirmed by seismic survey and a well was drilled on the structure. In June 1939 oil was proved at a depth of 1900 ft in the top sandstone of the Millstone Grits. On test, this well gave an initial yield of about 12 tons per day, thus proving a commercial oilfield. Once war started, drilling and exploration was concentrated in the Eakring area and as a result of seismic exploration a further culmination on the Eakring Anticline was discovered at Dukes Wood and two new smaller oilfields, Caunton and Kelham Hills, were located. In all, some two hundred and

fifty wells were drilled to exploit these fields. Incidentally, they are still producing at an annual rate in the order of 50,000 tons.

In this area also, some twenty other possible structures were tested by over forty wells without any success until 1953, when the small Plungar oilfield was discovered, and in 1955 another oilfield was proved at Egmanton.

The sequence of events in the East Midlands has been dealt with at some length as it has followed the logical pattern of selecting an area with potential source, reservoir, and cap rocks, as well as numerous surface oil indications, then the search for a suitable closed structure in the area, the drilling of a test well on the culmination of the structure, and, once an oilfield was proved, the concentration of the search in the immediate area of the proved oilfield. In addition it is the only area where the course of exploration has proceeded so far.

The Formby Field

Several important seepages have been known in the Formby area of Lancashire for a long time. These seepages occurred over a fairly wide area covered by glacial drift and recent deposits in the order of 100 ft thick. These glacial deposits overlie Triassic rocks which are of continental origin and therefore unlikely to be the source of the oil. The Permo-Triassic rocks, in this area the Permian rocks are also of continental origin, overlie Carboniferous beds and it was thought that these were the ultimate source of the oil. The surface geology of the area was complex and largely unknown and exploration was started by drilling shallow holes in the major seepage area with the dual object of finding the immediate source of the oil, and of determining the structure of the Permo-Triassic rocks in the hope that this would offer some indication of the Carboniferous structures. The second shallow well drilled produced oil at the rate of 60 gallons per hour from the Trias at a depth of 125 ft. This show was followed up and some forty shallow wells were drilled to define the oil pool which was proved to occur in a fault trap in the Keuper with glacial boulder clay acting as a cap rock. Other possible similar traps were drilled without success. This shallow drilling confirmed faulting in the Triassic but since it offered no clue to the Carboniferous structure, a gravity survey was made of the area. The results of this survey were indeterminate and the first deep test, Formby No. 1, was drilled in the area of the shallow pool. It found no trace of oil. Since then both seismic refraction and reflection surveys have been run and a further four deep test wells have been drilled. No production has been obtained. The shallow oil pool still produces steadily and it is obvious that it is being replenished from below.

Scotland

To round off this very brief summary of the progress of exploration for Carboniferous oil mention must be made of the Midland Valley of Scotland. This was another area first drilled in 1918-22. Traces of oil were found. It also was re-investigated in the late 1930s, both by D'Arcy and the then Anglo-American Oil Company (now Esso Petroleum Company). In all, some twelve wells were drilled. Anglo-American found a little oil and D'Arcy proved a gas field at Cousland. Cousland No. 1 on test produced gas at the rate of 10 million cu. ft. per day from four sands in all. Downflank drilling proved that there was no oil present on the structure and that the gas rested directly on the water. Arrangements are being made to conduct a prolonged test of the gas production in No. 1 well.

Other Areas

The other two favourable systems in Britain are the Permian and Jurassic.

The Permian prospects are confined to North-East England, where the Permian is developed in a marine facies and consists of two limestones separated by a salt series and overlain by a series of saliferous marls. Interest in Permian oil was aroused when oil was discovered in the Permian of North-West Germany, since the Permian of North-East England belongs to the same geological province. In 1938 D'Arcy Exploration Company drilled a hole to test the Permian limestones on the Eskdale anticline. This well, Eskdale No. 2, produced gas on test at a daily rate of 2,500,000 cu. ft. per day from the Upper Permian Limestone. It also proved the existence of a valuable series of potash salt deposits. Subsequent drilling was undertaken by ICI to investigate these salt deposits and one of these wells proved gas in the Lower Limestone.

The Jurassic prospects in Britain are confined to two areas in Southern England, the Weald and the Hampshire Basin. Oil seepages are fairly frequent from Jurassic and Lower Cretaceous rocks in these areas and at Heathfield, Sussex, gas from a borehole drilled in the nineteenth century was used for many years to light the station there. Altogether some thirteen deep and shallow wildcats have been drilled to test various structures in these two areas. No commercial production has been obtained.

It is unlikely that the U.K. will ever become self-supporting with regard to petroleum but it is more than likely that several other small oilfields of a size similar to that of the known fields will be discovered.

★ ★ ★

HD OILS

The following additional oils have been approved by the Director of Chemical Inspection, Ministry of Supply, as complying with the requirements of Defence Specification DEF-2101-A.

Supplier and Supplier's Nomenclature	*OMD Grade of Oil*
Shell Italiana S.p.a.	
Shell Oil S.4698	40
Shell Oil S.4699	60
Shell Oil S.4700	110
Mineralolwerke Albrecht & Co	
MAC HD 10	40
Stevinson, Hardy & Co Ltd	
SH(II) OMD-40	40
Manchester Oil Refinery Ltd	
Primor 30(M) HD	110
Primor Mil 20W HD	60
Shell Petroleum Co Ltd	
Shell Oil S.4895	40
Wintershall A.G.	
Salzbergen HD S.A.E.50	330
Valvoline Oil Co	
Valvoline Super H.P.O. S.A.E.10	40
Valvoline Super H.P.O. S.A.E.20	60
Valvoline Super H.P.O. S.A.E.30	110
Mobil Oil Co Ltd	
—	40
—	110
4310 TH.1414	40
Shell-Mex and BP Ltd	
Shell Oil S.4755	110
United Oil Co (Stoke-on-Trent) Ltd	
Pennrol Plus H.D. 10W	40
Pennrol Plus H.D. 20 20W	60

Atomic Energy for Petroleum Processing

In the largest gamma irradiation cells in Europe, Esso Research Ltd are making experiments to find out what atomic energy can do to improve petroleum products and to make their processing easier. These experiments are being made at the new Wantage Radiation Laboratory by arrangement with the U.K. Atomic Energy Authority, who own the site and its facilities.

At present the radioactive source is cobalt-60, a radioactive-isotope of ordinary cobalt produced in an atomic pile. Later—in about three years' time—radioactive caesium will be used, for this material will then be available in some quantity from atomic waste. From within 11-foot thick concrete walls where they are stored, the radioactive sources can be pushed by flexible wires through long stainless steel pipes into the cells where the experiments are carried out. These cells too are surrounded by thick

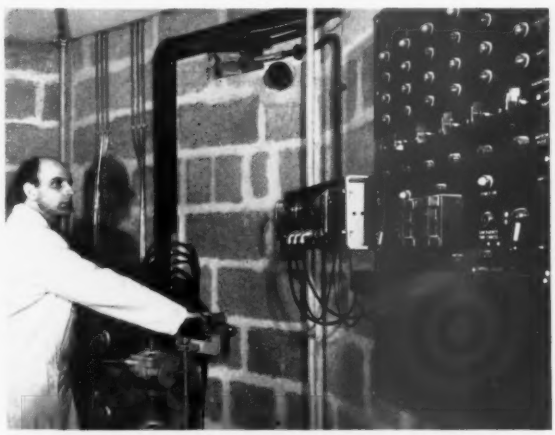


Fig 1. *Dr Michael Hoare, Esso Research Ltd, watching the source control panel at Wantage. Until the source is returned to storage by the electric motors, the radiation cell door cannot be opened.*

concrete walls through which the entrance passages wind like a labyrinth to prevent atomic rays from escaping. The sources are enclosed and always handled by remote control, with automatic interlocking devices to prevent access to the cells unless the sources are wound back into their storage chambers. Although gamma rays emitted by the sources are potentially so hazardous, like X-rays, which they closely resemble, they do not induce radioactivity in the materials they fall upon, so that once the sources are removed the experimental materials are quite safe to handle.

Besides the gamma-ray sources, equipment at the Wantage Radiation Laboratory also includes a source of beta-rays, *i.e.* very fast electrons. In addition, the Company has been granted facilities for the irradiation of experimental materials in the atomic piles at the Atomic Energy Research Establishment at Harwell, which is conveniently near to its laboratories at Abingdon.

Fig 2. *Using a hand radiation-monitor to check that all is safe before entering the cell.*

For Esso Research, much of the early work with these facilities will be purely exploratory, *e.g.* ways in which refinery processes can be made simpler or cheaper will be looked for. Many processes must now be operated at around 1000° F. This is because most chemical reactions require what is called "activation energy" to enable them to begin; they need, as it were, a "push over the hill". Normally this "push" is provided by heating the reaction mixture—if need be, keeping the reacting compounds from boiling away by increasing the pressure. By this sort of treatment, heavy residual petroleum mixtures can be cracked to more useful petrol or diesel fuel. Scientists have realized for many years that the very high energies of

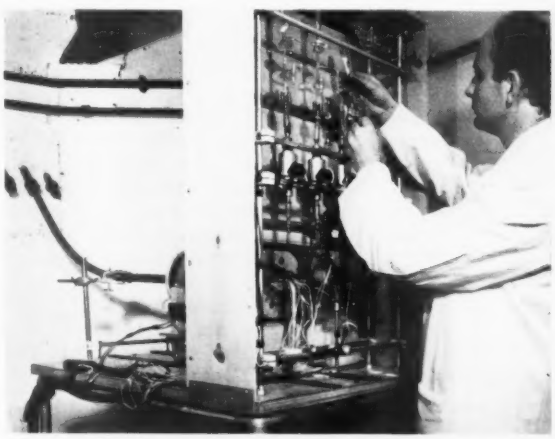


Fig 3. *Adjusting equipment inside the cell. To the left is the long stainless-steel pipe through which the source moves. Provision is made for using two more sources if more powerful radiation is required.*

Fig 4. *Measuring the progress of the reactions proceeding beyond the protecting wall. Most controls are completely automatic.*

atomic radiations might provide the required activation energy, but until recently no supplies of radioactive material were conveniently available and too little was known of the techniques that would be necessary. Now, as a result of experiments of the sort going on at Wantage, it may well be found that atomic radiations will serve as a substitute for heat and pressure in starting certain reactions among hydrocarbons, and that once started the reaction will go to completion without the need for further activation. If atomic energy can be used in this way, considerable economies in fuel and other materials should become feasible.

More than this, work with atomic radiations is already showing that entirely new materials and reactions are possible—reactions that just do not occur without the use of atomic energy. Thus, it is known that gamma rays can cause certain molecules to join together to make cross-linked polymers that cannot in practice be made in any other way.

The first task is to find out what reactions are affected by atomic radiations, how they are affected, and to what extent. The products of the experimental processes are carefully evaluated in the laboratories of Esso Research and the results applied to the continuous search for better petroleum products. The work is expected to expand considerably in the next few years.

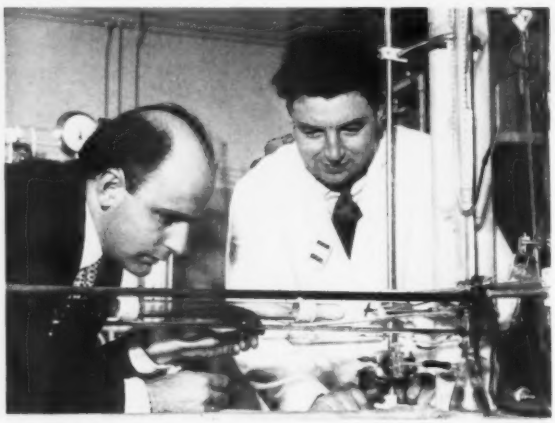


Fig 5. *Discussing the development of another piece of apparatus.*

Conferences, Courses, and Exhibitions

British Plastics Exhibition

As reported in these columns in March, the International British Plastics Exhibition will be held at Olympia, London, on 10-20 July.

Tickets for all sessions may be obtained free of charge from the organizers, *British Plastics*, Dorset House, Stamford Street, London, S.E.1.

Vapour Phase Chromatographic Courses

Due to the increasing demand by industry for vapour phase chromatographic analysts, the Podbielniak Institute is to devote three new courses each year exclusively to the techniques of vapour phase chromatography. The training schedule offered is a balanced combination of theory and practical application packed into an intensive training course strictly restricted to men in industry.

The third course this year will be held on 20 May. Further details and an enrolment form are available on application to the Podbielniak Institute, 341 E. Ohio Street, Chicago 11, Ill.

European Chemical Engineering Congresses

The objects and scope of the following congresses and meetings are outlined in a 16-page invitation brochure which is available on application to DECHEMA, 16 Frankfurt am Main 7, Postfach, Germany:—

ACHEMA 12th Chemical Engineering Exhibition and Congress, organized by DECHEMA, to be held at Frankfurt am Main from 12 May to 8 June 1958.

2nd Congress of the European Federation of Chemical Engineering, starting in Brussels on 28 and 29 May and continuing in Frankfurt am Main from 31 May to 8 June 1958.

2nd Congress of the European Federation of Corrosion, to be held at Frankfurt am Main from 31 May to 8 June 1958.

Special Meeting and Lectures 1958 of the Gesellschaft Deutscher Chemiker.

Annual Meeting 1958 of Deutsche Gesellschaft für Chemisches Apparatewesen.

The brochure states that particulars of additional meetings will be published in the autumn of 1957.

Automatic Measurement of Quality in Process Plants

A Conference on the above subject will be held at the University College of Swansea on 23-26 September 1957. The topics include chromatography, mass spectography, pH-measurement, spectroscopy, and titration.

Application forms for membership of the Conference, together with some details of the programme, are being sent out this month to those Members of the Society of Instrument Technology who are known to be active in this field. Others who wish to receive such notification should write to The Secretary, S.I.T. Ltd, 20 Queen Anne Street, London, W.1.

At the Birmingham Students Dinner the toast of "Coal as a Raw Material" was proposed by Professor F. H. Garner, O.B.E. (left) *and replied to by Dr J. Bronowski. B. Atkinson proposed the health of "The Guests" and, in responding, J. R. S. Morris also proposed the toast of "The Society", to which its chairman, R. G. Brewster replied.*

Coal as a Raw Material

Dr J. Bronowski at Birmingham Students' Dinner

Coal as a Raw Material

The theme of this year's annual dinner, the tenth, of the University of Birmingham Chemical Engineering Society and the Student Section of the Institute of Petroleum, was "Coal as a Raw Material". Consequently, it was fitting that the guest of honour should be Dr J. Bronowski, director of the National Coal Board's Central Research Establishment at Stoke Orchard. It was held on 5 March.

The toast was proposed by Professor F. H. Garner, O.B.E., who occupied the chair, and he said that although coal had been included in the main theme of the toast on previous occasions, this was the first dinner at which it had been the principal subject.

The most important problems of the present time were the future demands for engineers and technologists and the future demands for energy. The latter was largely dependent on the former.

H. Gilmour, M. Tayeban, Professor F. Morton (Manchester College of Technology), and P. Mina, with J. G. Hughes in the background.

Coal and Oil Main Energy Sources

Recently in the House of Commons, said Professor Garner, it was stated that the energy requirements of Britain would reach the equivalent of 310 million tons of coal annually by 1965 and 370 million tons by 1975. Of these quantities, some ten per cent could be supplied by atomic energy by 1965 and a larger proportion by 1975. Therefore coal and, to a minor degree, oil were to be the main sources of energy for many years to come.

Even in a completely nuclear age, he said, only part of man's requirements could be supplied by energy alone. This energy was already required for the processing of natural raw material such as mineral ores, products from vegetable sources, together with the fossil fuels, coal, and oil.

Technical Foresight Essential

Dr J. Bronowski, replying to the toast, said that the industrial survival of Britain depended on the talents of them all backed by the desire and energy to work. Coal would not be able to provide the same proportion of energy in twenty years time as it had twenty years ago.

An outstanding feature of British technology since the war had been that as far back as 1945 we had been planning for atomic energy. The marvels of Calder Hall, Dounreay, or some other reactor were by comparison far less impressive in their technical development than in the technical foresight which gave them their creation. In the evidence to the U.S.A. Senate Commission in 1945, dogmatic statements were made that only the know-how mattered, and that that was not known in the outer darkness east of the Atlantic, or east of the Urals—depending on the political situation at the time.

However, in 1945 British scientists looked into the future and planned accordingly. Such planning and such foresight were more important than know-how.

Now, in 1957, certain profound questions must be asked about coal planning. The oil crisis had raised one question. Consider, said Dr Bronowski, what was said in the House of Commons three months ago about the amount of petrol expected in Britain, and compare those statements with the

J. R. S. Morris and A. C. Gill of the Department's Staff, obviously recalling pleasant memories.

stock position to-day. If the planners cannot think three months ahead, it will fall on modest scientists to think years ahead. The dependence on oil will have to be reversed and prospects of atomic energy put in their perspective.

The function of atomic energy in the foreseeable future will be to go into the power stations, which at present take 20 per cent of our coal. Atomic energy can and must overtake coal there, but it is not able to cater for the other 80 per cent of coal users. However, if all the power stations stopped using coal tomorrow, householders and other users could not use the coal which would be freed. It could not be burned in their appliances.

Coal was now faced with the same problems of foresight as those facing the atomic engineers in 1945. It had to provide for the 80 per cent of other users and leave the power stations progressively to atomic energy. Although Britain was producing more coal, he said, much of it was smoky and small and could only be used by the power stations. It was not possible to get from the ground the lumps of coal as were produced in 1930.

A Treatment Industry Necessary

For centuries the coal industry had existed as an extraction industry only, but it must be converted into a treatment industry and process its raw materials into products of use to railways, householders, and other users, said Dr Bronowski. The public mind was full of questions as to why Britain no longer exported coal but, he said, only backward nations dug stuff from the ground and then sent it to other people to use. As a great industrial nation Britain had no right to be exporting coal but must instead export iron or steel or finished products. Far more use must be made of the coke, smokeless fuels, and by-products which were released by their manufacture. Coke was the most important single chemical in Britain. In the long run coal must even be turned into liquid fuel.

To solve its problems the coal industry would need to use more modern methods on a far wider scale and the decisions must be taken by those who clearly saw the basic task set by the chemistry of coal. Concluding, Dr Bronowski said that there was a task of coal processing to be done by a new generation of chemical engineers. To them the coal industry offered an exciting career.

The toast of "The Guests" was proposed by B. Atkinson, junior treasurer, and replied to by J. R. S. Morris, who in turn proposed the health of "The Society". B. G. Brewster, the Society's chairman, responded.

A. S. White (AERE), D.C. Freshwater, who was shortly to leave Birmingham for Loughborough Technical College, and W.E. Aylwin (Midland Tar Distillers Ltd).

MIDDLE EAST PRODUCTION

	Tons	
	Feb.	*Jan.-Feb.*
Iraq Petroleum Co Ltd	108,301	213,069
Basrah Petroleum Co Ltd ...	611,081	1,413,869
Mosul Petroleum Co Ltd	116	124
Qatar Petroleum Co Ltd	451,219	949,919
Iraanse Aardolie Exploratie en Productie Mij	2,732,000	5,414,000

The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for February was 1,379,000 tons, the total for 1957 being 2,793,000 tons.

INFLATABLE HUT

A "Numex" inflatable hut, details of which were given in these columns last year, is at present being used by the British Antarctic Expedition. Dr V. Fuchs, leader of the Expedition, has wired the manufacturers to say that the hut is invaluable for vehicle repairs, despite 30-knot winds and temperatures ranging between -4° and $+20^{\circ}$ F.

Folded, the hut measures 4 ft 6 in x 18 in x 18 in, and this can be erected, single-handed, with the aid of a small electric blower in 3 minutes. Its overall size is 30 x 19 x 9 ft high and no poles are required as stabilizers.

Further details are available from Elliot Equipment Ltd, 5 Falmouth Road, Slough.

Pipe alignment and welding operations on the Ahwaz-Azna pipeline.

Pipeline into Persia

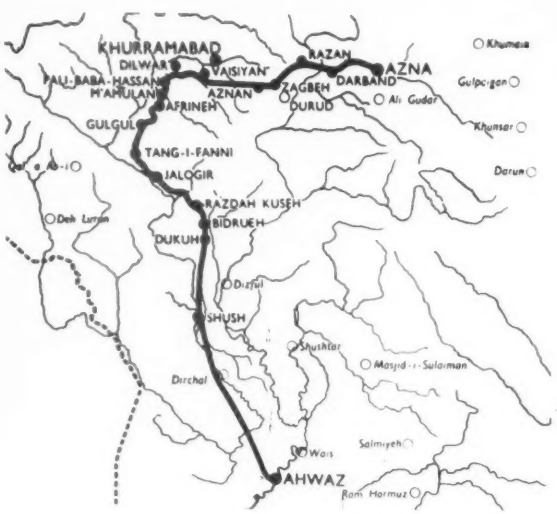
Central Portion of Abadan-Teheran Line Completed

Hitherto, refined petroleum products such as gasoline, kerosine, and gas oil required for use in the northern part of Persia around Teheran, the capital, have had to be carried by road or rail. The journey has been an arduous one, whether by the 700-mile road crossing the coastal desert plain and then winding 7000 feet up through the rocky gorges and passes of the Zagros mountains, or by the single-line rail route.

Shortly those products will travel the whole way by pipeline, for the existing line between Abadan and Ahwaz is being extended to Teheran itself. Already the 300-mile stretch of the new line between Ahwaz and Azna, is in operation thanks to the efforts of Costain-John Brown Ltd, who completed this section early in January several months ahead of schedule. The 270-mile link from Azna to Teheran, with one pumping station, is being constructed by a French firm. Oil first flowed through the Ahwaz–Azna line on 14 January.

The contract for the Ahwaz–Azna line, worth £6·5 million, was awarded by the National Iranian Oil Company to Costain-John Brown Ltd in May 1955 and, after preliminary surveying and design work, work on laying the line started in February 1956. The contract called for completion within two years.

The first 90 miles across flat desert country was completed in 49 days at an average rate of $1\frac{3}{4}$ miles per day and over 3 miles per day on several occasions. The most difficult terrain which the line had to traverse was through the Zagros mountains, where gradients of one-in-three were often encountered. The route was along gorges through which the Kashgan river runs. This swiftly-flowing river varies in depth from 2 to 20 feet according to season and the line had to cross it in 27 places. The highest point reached by the line is at Razar Pass, about 7000 feet, from where it begins the descent to Azna.



Nominal diameter of the pipe is 10 inches and outside diameter $10\frac{3}{4}$ inches. Wall thickness, generally 0·279 inch, is as much as 0·344 inch where physical conditions and hydraulic gradients require this. Total weight of pipe used was about 28,000 tons.

The line was welded throughout and, as each continuous length was completed, the welds were gamma-ray tested for faults, the necessary radioactive isotopes having been

flown to Persia from Harwell. Every section was then tested by air pressure and, finally, the whole line was hydraulically tested.

Pumping Stations

Throughout the 270-miles length of this pipeline there are four pumping stations, the pumps being driven by diesel engines each having an output of 540 h.p. at 500 rev/min.

The first station is at the start of the line at Ahwaz, and the second a hundred miles across the plains at Bedruwi. From here the line climbs over the Tang-i-fanni pass to the third station at Afrenah, and then on through the Vaspar Gorge to the last station near Khurramabad. At each station, storage tanks are provided, their total capacity being 2·25 million gallons. The stations will be operated by Persian staff.

There is one other station at Abadan, and a sixth station is at Azna and built by the French company.

These six stations are sufficient to handle the present capacity of the line, which is about one million tons of petroleum products per year. When the line is completed in its final phase, the throughput will be doubled and for this purpose the number of pumping stations from Abadan to Teheran will be thirteen.

THE OPERATION FILMED

During the construction of the Ahwaz–Azna line a colour film was taken of the operation. This film—*Pipeline into Persia*—was recently shown in London and, while it gave an excellent account of the work of pipeline construction under very arduous conditions, it was particularly interesting for the very fine shots of Persia and the antiquities to be found there.

Introducing the film, R. M. Wynne-Edwards, managing director of Costain-John Brown, paid a tribute to the enthusiasm of the Persians and to the assistance given by the NIOC. These factors were, he said, of considerable help in enabling the line to be completed four months short of schedule.

(Above) *The pumping station and main storage tanks at Pali-Baba-Hassan, and* (right) *cold-bending a length of pipe, a delicate and skilful operation.*

Esso's Largest Tanker Launched

Esso Guildford, launched on 28 March from the Bremen yard of AG Weser, is the largest tanker so far constructed for Esso Petroleum Co Ltd, being of 36,040 dw tons. She is also the first of fifteen tankers at present under construction or on order for Esso, eleven of which will be of 36,040 dw tons and the other four of 47,400 dw tons. The vessel was named by Mrs Pinder, wife of R. J. Pinder, a managing director of Esso Petroleum Company, and among those present at the ceremony were the Mayor and Mayoress and the Town Clerk of Guildford and his wife, and the Burgomaster of Bremen.

Details of the *Esso Guildford*, which is constructed to Lloyd's Classification +100A1 for carriage of oil in bulk, are:

Length overall	690 ft. 0 in.
Length between fore and aft perpendiculars ...	660 ft. 0 in.
Breadth moulded	90 ft. 0 in.
Depth moulded	47 ft. 0 in.
Draft loaded	35 ft. 5 1/8 in.
Deadweight carrying capacity	36,040 tons
Service speed	17 knots
Normal power	16,000 SHP
Bunker consumption per day at sea	93 tons

Of welded construction of Lloyd's requirements, the vessel is, in order to provide adequate strength, longitudinally framed throughout the tank length with transverse framing at the ends. The eleven cargo sections are longitudinally divided by two bulkheads to give 33 tanks, No. 5 being arranged for water ballast only.

Aluminium-brass heating coils are fitted to all tanks as well as a steam smothering system. Two derricks only are provided for hose handling, and stores are loaded by an electric hoist under the docking bridge aft. As a result of rolling tests on models, bilge keels have been eliminated. Cathodic protection is installed to protect the internal structure from corrosion.

Cargo pumps are four in number and turbo-driven with a capacity of 5000 gallons per minute each. A ballast pump, of 3300 gallons per minute capacity, is directly connected to No. 5 tank, and two stripping pumps are also provided.

All accommodation for officers and crew is air-conditioned, this being the first Esso tanker to be so fitted.

Propulsion of *Esso Guildford* is by a single screw, driven by a set of turbines comprising one high-pressure ahead, one low-pressure ahead, and one astern driving through double-reduction articulated gearing. At 100 rev/min the turbines can develop a service power of 16,000 shp. Steam supply is from two Babcock & Wilcox oil-fired water-tube boilers giving 850 psig at 865° F at superheater outlet. The fuel system is arranged for using residual fuels of high viscosity. To ensure uncontaminated feed-water, two Weir-Lawson de-oilers will filter the condensate and an evaporating plant is provided to distil sea water.

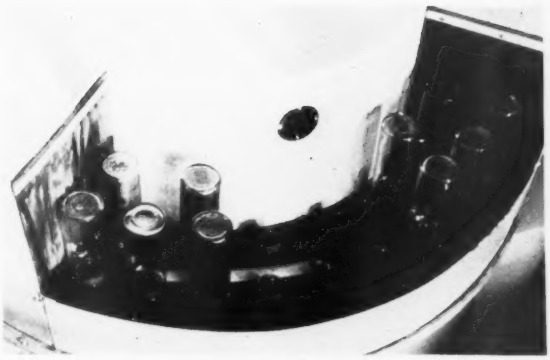
Mechanized Bottle Washing

According to a recent statement in the daily press, many million milk bottles have to be replaced each month by the dairy industry. Whilst the petroleum industries' consumption of sample bottles is not quite on this scale (it is of course not unknown for milk bottles to find their way into oil laboratories!), the number of new bottles that had to be drawn from refinery stores was, in the case of one laboratory at least, sufficiently alarming to call for investigating means of both decreasing the bottle consumption rate and economizing on the time and labour expended in their cleaning. Moreover, the cleaning process when, as is usual, this is carried out manually by the most junior member of the laboratory staff, is often inefficient and frequently requires to be repeated when an allegedly clean bottle is drawn from laboratory reissue stock.

A brief survey of possible means of mechanizing this tiresome laboratory chore indicated the feasibility of commercially available bottle cleaning equipment being modified to suit the standard size of 16-oz (450 ml) laboratory sample bottle. The makers (Thomas Hill Engineering Co (Hull) Ltd) were most co-operative and after preliminary trials with very thoroughly soiled bottles had been satisfactory, a bottle-cleaning machine was purchased.

This equipment has a capacity of 720 bottles per hour; as already mentioned, it was designed for the 16 oz size but smaller bottles, or even test tubes, can be inserted. Essentially the machine consists of 60 jets each approx $\frac{1}{8}$ inch diameter and $2\frac{3}{4}$ inches high. These jets are placed on the periphery of a rotating turntable, which completes one revolution in 5 minutes. The sequence of operations is that a bottle is placed, neck downwards, over the end of a jet and then passes into a tunnel divided into three sections. In the first, a spray of white spirit (at room temperature) is directed at and into the bottle and dissolves out any residual oil which it may contain or which may adhere to the external surface; in the next section, the wash fluid is a hot aqueous solution of detergent (Teepol), whilst the final portion of the tunnel is devoted to a hot water rinse. The bottle then emerges close to the point of entry, is manually removed from the machine, and placed in a rack which is inserted in a steam-heated drying oven. (This oven is a separate item of equipment and quite distinct from the bottle washing machine).

Fig 1. *The bottle-washing machine supplied to Lobitos Oilfields Ltd. The gauges on the control panel indicate temperature of detergent and water rinses, which can be varied.*



Photographs by W. P. Dore

Fig 2. *Dirty bottles* (left) *entering the machine and clean ones emerging* (right).

The turntable and necessary pumps are electrically driven, the total current consumption being 1100 watts. In addition to electricity, steam and water connexions are required. The white spirit is supplied by gravity from a 45-gallon drum. Consumption of this latter is at a rate of about 15-20 gallons per 1000 bottles, but as the soiled spirit is returned to refinery slop, little more than the cost of redistillation is involved. The detergent solution ($1\frac{1}{2}$ per cent) is held in a 17-gallon tank and requires renewal after processing about 1000 bottles, soiled to an average extent. Hourly water and steam consumption are approximately 100 gallons and 20 lb respectively.

The temperature of the aqueous fluids can be varied as desired; the solvent used in the first stage and the detergent wash can, of course, also be changed to suit conditions.

Operation over nearly a year has shown a striking economy in bottle consumption which has fallen from an annual rate of 40,000 bottles (approx cost £900) to 18,000 bottles (approx cost £400). The purchase price of the equipment was £700, to which must be added the cost of installation, solvent storage, drying oven, transfer racks, etc. In addition to the annual saving of about £500 in the cost of bottles, there is a further economy in reduced labour charges, since instead of being a full-time job for one junior, all the bottles required by the laboratory and other departments of the refinery can be cleaned at an average daily operating time of the bottle-washing machine of only $1\frac{1}{2}$ hours. Moreover, and this is a point of great importance, especially for a laboratory carrying out tests on such specialized products as white oils and electrical oils, the bottles now reissued are really clean; if there is the slightest doubt after a bottle has completed a circuit in the machine, it is merely left on for another trip round the cycle; it is however only in the case of very dirty bottles indeed that such a recycling may be necessary.

MANKIND'S STAKE IN MIDDLE EAST OIL

Summary of an address which B. Brewster Jennings, chairman of Socony Mobil Oil Co, delivered to the annual meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, in New Orleans on 26 February 1957

The Free World produced and used nearly 16 million barrels of petroleum a day in 1956, 57 per cent of which was consumed in the United States. Free Europe used about a sixth of the total.

Oil consumption is going to increase soon. Over the past five years demand in the United States has grown at the rate of about 5 per cent a year; in Europe demand has risen 12 per cent annually; in less developed countries the rise has been more rapid. It seems not unreasonable to expect that between 1965 and 1975—if not sooner—the Free World will need twice as much oil as it does to-day.

Last year's oil production in the United States, while less than its consumption, was 48 per cent of the Free World's total; the Middle East supplied 23 per cent and Venezuela 17. Can a continuance of supply in those proportions from those sources be counted on?

United States petroleum production in 1956 was 8·1 per cent of domestic proved reserves, Venezuelan production was 6·8 per cent of its reserves, but Middle East production was only 1·3 per cent of its reserves. The principal Western Hemisphere sources of oil are being drawn on five to seven times as fast as those of the Middle East.

If present trends persist, the Western Hemisphere will run out of oil before the Eastern Hemisphere does.

How about the chances of finding more oil? Since Colonel Drake completed the first producing oil well in the United States 98 years ago, a total of 1,638,000 petroleum wells have been drilled there. Those wells proved 94 thousand million barrels of oil, of which some 58 thousand million have already been produced.

In Venezuela something like 18,000 wells have been drilled and over 21 thousand million barrels of petroleum found, of which 8 thousand million have been consumed. In the Middle East countries, around the Persian Gulf, fewer than 1500 wells have been drilled, but they have yielded at least 105 thousand million barrels.

Most of this Middle East oil has been found with a minimum of exploratory effort before drilling. The potential acreage of the United States has been pretty exhaustively explored, and practically all conspicuous structures have been tested. Some day an effective tool may be developed to find stratigraphic traps, and there may be many thousands of millions of barrels in them.

The average oil well in the United States produces 12 barrels a day compared with 5000 in the Middle East. It is more dramatic to say that it has taken a mile of hole in the United States to prove as much oil as five feet of hole in the Middle East.

At present the United States and its North and South neighbours are self-sufficient in petroleum, but that should not lead to complacency. Nations cannot hope to be self-sufficient, either politically or economically. Not even a hemisphere can any longer aspire to that.

In the area of economics, the interdependence of Free World countries is equally evident, and continued access to Middle East oil is important, not only because Europe and Asia and Africa are dependent on it now and the Western Hemisphere may well be tomorrow, but also because the Free East and the Free West are inescapably dependent on each other.

In the oil industry the term Middle East is regarded as including Iraq, Iran, Kuwait, Saudi Arabia, Jordan, Lebanon, Syria, Israel, and Egypt, plus the Sheikhdom of Qatar, the Island of Bahrain, and a number of smaller sheikhdoms along the Trucial Coast, and finally Aden with its protectorate, and Yemen.

The area as a whole is, by Western standards at least, lacking in industrial development, and except for oil relies largely on agriculture for its economy. Apart from the Tigris, Euphrates, and Nile Valleys and the Mediterranean littoral, it is a land of little rainfall or other water resources. Agriculture is therefore arduous, and such animal husbandry as exists is by nomadic families and tribes, the Bedouins.

Governments vary from feudal sheikhdoms, through absolute monarchy as in Saudi Arabia to the parliamentary democracies of Iran, Iraq, and Lebanon. Perhaps "Dictatorship" would best characterize the present governments of Egypt and Syria, although on paper both are democracies with presidents, prime ministers, and legislatures.

All except Iran and Israel are Arab countries with strong Arab nationalistic feelings. There is, of course, deep love of country, by the Iraqis for Iraq, the Lebanese for Lebanon, etc. But there is unquestionably a very strong pan-Arab bond which underlies the feeling of these peoples for their land, and this strong Arab feeling of kinship is a factor of first importance in the Middle East—it cannot be ignored, and it would be unrealistic to ascribe all of its unpleasant manifestations to Russian influence.

Before the Suez crisis, Middle East oil production was about 3·7 million barrels a day. With the exception of about 820,000 barrels moved by pipeline to ports in Syria and Lebanon and small amounts used locally, the balance moved by tankers. Of this about 1,500,000 barrels daily went to western destinations via the Suez Canal.

Oil revenues are the preponderant economic element of the Middle East to-day. Kuwait with a population of 200,000 enjoys the revenue from 1·2 million barrels a day; Iran with 20 million people has 600,000 barrels a day; Iraq and Saudi Arabia have respectively nearly 5 million and 7 million populations and 800,000 barrels and about 1,000,000 barrels a day of oil production. Obviously oilfields and population have no visible relationship.

Jordan, a very poor country, picks up some revenue from 220 miles of Tapline pipeline and Syria and Lebanon are both transit countries. Each country also derives some income from the big tanker terminals on the Mediterranean.

While Middle East oil production is distributed among four major producing countries, Syria, Lebanon, or Jordan, all non-producers, can cut major pipelines. And Egypt, with relatively little oil production, can and has closed the Suez

Canal to all of the west-bound Persian Gulf oil. Thus, control over transportation is almost entirely dissociated from the countries with oil production.

The United States and, perhaps even more so, its European allies, have a problem that is all too evident.

There are two broad approaches. The first would be to establish and maintain such relations with the Middle East countries that they will not arbitrarily withhold their oil. This ought not to be unduly difficult. There is a strong mutuality of interest and a surprising amount in common between East and West.

Perhaps the greatest difficulty in dealing with the Arab peoples is that many of them lack background and experience in larger commercial transactions. Then, too, it is difficult to negotiate a contract in Arabic, and even more difficult to reduce it to writing. Yet, if they are dealt with in good faith, patiently, and with due regard for their intense nationalism and pride in their comparatively new independence success can be achieved. Both have so much to gain from a close relationship.

The other approach must be along the line of achieving a reasonable dispersal of commitments. Much can be done to better disperse operations, by building additional pipelines over routes which avoid the possibility that all can be shut down by one government. More pipelines will reduce the importance of the Suez Canal.

Another offset to the Canal might be very large tankers, which could proceed via the Cape of Good Hope, and by virtue of the size of cargo achieve fairly low cost of freighting. But even tankers of 100,000 deadweight tons travelling via the Cape would suffer some disadvantage costwise as against a ship of say 40,000 d.w.t. transiting the Canal, but the disadvantage would not be ruinous.

Some protection, at least against interruptions of short duration, can be obtained by carrying larger stocks of petroleum products in the consuming countries. It is expensive to build tankage and idle inventory is costly. To have in each producing country some excess of producibility, together with a reserve of facilities to handle it, is insurance against a shutdown elsewhere.

All of these ideas, and others, are under consideration by oil people and by governments in all parts of the Free World. Standby facilities of any kind are costly. It could be more costly not to have them.

WELLS DRILLED IN THE U.S.A. IN 1956

The following figures are taken from the annual survey of the U.S.A. petroleum industry published by *The Oil and Gas Journal* in its issue dated 28 January:

Field wells:		
Oil wells	29,545	
Gas wells	3,646	
Dry holes	11,935	
		45,126
Wildcat wells:		
Oil wells	1,613	
Gas wells	469	
Dry holes	10,952	
		13,034
		58,160
Footage drilled (1000 ft):		
Field wells	171,875	
Wildcat wells	62,027	
		233,902
Well depth (feet):		
Over 15,000		142
12,500–15,000		815
10,000–12,500		1,678
7,500–10,000		4,129
5,000–7,500		8,526
3,750–5,000		8,942
2,500–3,750		14,169
1,250–2,500		14,174
Below 1,250		5,585
		58,160
Drilling methods:		
Rotary		48,676
Cable		9,484
		58,160
Rigs in operation:		
1 January		3,023
31 December		2,759

Deepest drilled and producing well in the United States is the Richardson & Bass 1 L.L.E.—Humble "L", Plaquemines, South Louisiana, which was completed at a depth of 22,570 feet. This well flowed at the rate of 206 brl of oil per day on a $\frac{1}{2}$-inch choke from Miocene sands at 21,443 to 21,465 and from 21,419 to 21,435 feet.

★ ★ ★

U.S. NATURAL GAS

Marketed production of natural gas in the United States during 1955 totalled 9,405,351 million cubic feet, compared with 8,742,546 million in 1954. In addition 1,504,804 million cu. ft. were used for repressuring (1,518,737 million in 1954) and 773,639 million cu. ft. were vented and wasted (723,567 million). Of the total production of 11,719,794 million cu. ft. (10,984,850 million), the quantity from gas wells was 7,841,958 million cu. ft. (7,466,007 million) and 3,877,836 (3,518,843 million) from oil wells.

Total consumption in 1955 was 8 per cent higher than in 1954. Details are:

	Volume *million cu.ft.*	*Consumers* *Thousands*	*Average Value* *c per M.cu.ft.*
1954			
Residential	1,894,248	25,327	89·3
Commercial	584,957	2,076	64·7
Field (drilling, pumping, etc.)	1,456,883	—	8·3
Carbon black	251,176	—	7·0
Refinery fuel	563,315	—	22·7
All other industrial	3,903,449	—	
	8,654,028		
1955			
Residential	2,123,952	26,084	88·7
Commercial	629,219	2,381	62·7
Field (drilling, pumping, etc.)	1,507,671	—	10·1
Carbon black	244,794	—	7·9
Refinery fuel	625,243	—	25·7
All other industrial	3,939,464	—	
	9,070,343		

Petroleum in Parliament

Imports of Petroleum and Petroleum Products

In a written reply on 26 March, the President of the Board of Trade said that imports of petroleum and most petroleum products were on open general licence except from the dollar area, the Soviet *bloc*, Japan, and Korea.

Scottish Shipbuilding Yards

In a written reply on 12 March, the Civil Lord to the Admiralty said that, as far as he was aware, two Scottish yards were equipping themselves to build 65,000-ton tankers. At least one other yard, he said, had plans for the extension of its berths.

Oil Supplies

In a written reply on 4 March, the Paymaster-General said that over the period November 1956 to January 1957 inclusive 2·6 million tons of oil were imported into the United Kingdom from the dollar area, as compared with 1·5 million tons in the corresponding period a year ago. The c.i.f. values reported for Customs purposes were, he said, £31 million and £17 million respectively.

Hydrocarbon Oils Duty

In a written reply on 19 March, the Chancellor of the Exchequer said that the total amounts of tax payable on hydrocarbon oils in the months of January and February 1956 was £45·6 million. The provisional figure for the same months this year was, he said, £49 million.

Petrol Emergency Tax

In a written reply on 21 March, the Financial Secretary to the Treasury said that the total revenue to date derived from the extra 1s. a gallon emergency tax put on petrol when the Suez crisis began amounted to about £25 million.

A week later, on 28 March, he said that the temporary increase in duty was designed to offset loss of revenue resulting from the reduced consumption of oil. According to the latest estimate for this financial year (ended 5 April 1957), the revenue was unlikely to exceed the 1956 Budget estimate of £340 million. As regards the next financial year, he said he was not in a position to give any undertaking beyond that contained in the Act.

The Minister of Power

The Prime Minister was asked on 26 March whether, in view of the complexities of the coal and atomic energy programme, involving more than £2000 million, and of the expanding use of oil for industrial purposes, he would appoint a minister from the House of Commons to be responsible for coal, gas, and oil. Mr. R. A. Butler, in reply, said: No, the Paymaster-General is the Minister answerable to the House for all matters within the responsibility of the Minister of Power.

Oil and Petrol Rationing Cost

In a written reply on 1 April, the Parliamentary Secretary to the Ministry of Power said that the cost to the Ministry of Power of administering the restrictions on oil consumption and petrol rationing to date was about £400,000, including about £250,000 payable to other Departments.

Middle East Treaties

In his statement to the House on 1 April, the Prime Minister said that two new projects for increasing the flow of Middle East oil were under consideration, including a new large pipeline through Turkey. At our Bermuda Conference, he said, we considered the desirability of a policy by which projects of this kind be given the additional protection of a treaty between the interested Governments to reinforce the usual agreements now made between the companies and the countries of transit. He considered that this would certainly be a source of stability and give confidence all round.

Dry Dock Accommodation for Tankers

On 13 March, the Minister of Transport and Civil Aviation said that he had held discussions with the interests concerned with Milford Haven, in regard to the provision of dock and dry dock accommodation for the large oil tankers of 60,000 and 80,000 tons which are now under construction or in contemplation, and important developments are in prospect there. He also said that a number of schemes at other places were also being actively pursued in consultation with his Department and the Admiralty.

Israel Oil Pipeline

On 3 April, the Minister of State, Foreign Affairs, said that H.M. Government had had no discussions with the Government of Israel in regard to the construction of an oil pipeline from the Gulf of Aqaba to the Mediterranean. In reply to a supplementary question he said the Government's view was that in view of the political situation in the Middle East it would be wiser to seek other ways for a pipeline, particularly the one through Turkey, than the one mentioned in the question.

BUDGET PROPOSALS

Overseas Trade Corporations

In introducing his budget proposals on 9 April, the Chancellor of the Exchequer said that United Kingdom companies controlled and managed from this country, but having all their trading operations abroad would be exempted from income tax and profits tax on their trading profits earned abroad. Dividends or other distributions to shareholders out of those trading profits would, however, be liable to U.K. Income Tax and if they were received by a U.K. company to profits tax as well. In appropriate cases there would be relief for taxes paid abroad.

Among the companies covered by his proposals were those wholly engaged overseas in oil winning. These proposals, he said, would not apply to shipping (*see* Investment Allowances, below).

Hydrocarbon Oil Duty

The Chancellor said that when the additional duty of 1s. a gallon was imposed on petrol and certain other light oils last December, it was made clear that the extra duty was temporary. He said that the Act lays down that it is to be removed not later than one month after the end of rationing of all the products liable to duty.

Although oil supplies were not yet back to normal they had improved sufficiently to justify the removal of the additional duty. He had therefore approved a Treasury Order, under which the duty would be restored to 2s. 6d. a gallon for light oil and derv fuel.

Investment Allowances

The Chancellor proposed that the investment allowance for capital expenditure on the construction of new ships shall be increased to 40 per cent as regards expenditure becoming due and payable after today (9 April).

Books and Films

Atomic Nomenclature

An interesting booklet on *Atomic Terms and What They Mean*, prepared by Esso Research and Engineering Company, New York, is available from Esso Research Ltd, Abingdon, Berkshire.

BSI Yearbook

The 1957 Yearbook of the British Standards Institution has just been published. Of its 480 pages, 400 are devoted to a complete numerical list of the approximately 3000 Standards and Codes of Practice current on 1 January 1957. The price to non-members of the BSI is 15s., or 16s. 6d. post free.

Combustion and Flame

Under this title the first issue of the *Quarterly Journal of The Combustion Institute* was published by Butterworths Publications Ltd (London) and Interscience Publishers Inc. (New York) in March. Editor-in-Chief is Sir Alfred Egerton. Annual subscription is £5 5s. ($16), or a combined subscription with *Fuel* is £8 8s. ($25).

Croydon—Past and Present

In view of the impending closure of Croydon Airport as an international airport, the March 1957 edition of *Transair Review* is of particular interest. It covers the history of Croydon from the time when it was first used in the 1915-17 period for training squadrons of the R.F.C. Profusely illustrated, it is issued by Transair Ltd, Croydon Airport, Surrey.

BOC and the Monopolies Commission

In response to the Monopolies Commission report on The British Oxygen Company, published on 2 January, the Company has issued a booklet explaining the considerations which weigh with it in regard to the two debatable issues —profits and research. It is pointed out that, of the present research and development budget of over £700,000 per annum, at least £500,000 is devoted to industrial gases and associated plant.

DCL Industrial Activities

At the last Annual General Meeting of The Distillers Company Ltd, the chairman, Sir Henry J. Ross, indicated that a brochure was being prepared to give information on the Company's industrial enterprises. That brochure has now made its appearance and is an attractive 56-page book packed with information and fully illustrated in colour. Among the activities mentioned are those of British Hydrocarbon Chemicals Ltd, Forth Chemicals Ltd, and Grange Chemicals Ltd.

Motor Sport in 1956

Forty-eight pages of action pictures sums up "Achievements 1956", a booklet illustrating successes in every field of motor sport and just issued by C. C. Wakefield & Company. The coverage is world-wide, its four sections dealing respectively with the Americas, Europe, Commonwealth countries, and the British Isles. There are many photographs of the leading car drivers and motorcyclists as well. Copies, free of charge, can be obtained from the Company at 46 Grosvenor Street, London, W.1.

Technology

This new "monthly review of training and education for industry", the first issue of which was published by *The Times* in March will fill a gap which has long been obvious in news literature. Millions are being spent on scientific and technical training and *Technology* has as one of its chief aims the provision of a platform from which the needs of industry can be made known and discussed. The field is wide and the standard set in the first issue is high. There seems every promise that the new Journal will quickly reach a place in the essential reading of all concerned with training and education. The price is 1s.

Safety Recommendations for Oil-fired Boilers

The Fire Protection Association have issued a useful booklet of safety precautions applicable to oil-fired boilers and space-heating installations of a size commonly found in private dwelling houses, small hotels, and small business premises.

Among the subjects dealt with are fuel, fuel storage, tank fittings, burners, chimneys and flues, electrical equipment, general precautions, and methods of extinguishing fires.

The booklet, which is entitled *Oil-fired Domestic Boilers and Air Heaters for Hot Water Supply and Space Heating*, is available free on request to the F.P.A., 15 Queen Street, London, E.C.4.

European Federation of Corrosion

The European Federation of Corrosion has published its first annual report, entitled "Jahresbericht 1955 der Europäischen Föderation für Korrosion und ihrer Mitgliedsvereine." This 54-page document is divided into three parts. The first part gives an account of the founding and development of the Federation up to the end of 1955; the second summarizes the activities of the individual member societies; and the third gives particulars of research organizations in European countries which are concerned with materials of construction and with means for their protection.

Copies of the report may be obtained from European Federation of Corrosion, Frankfurt am Main 7, Postfach.

Storage of Petroleum Spirit

A considerable service has been performed by the Fire Protection Association in producing a 19-page handbook summarizing the legal aspects of petroleum-spirit storage.

After dealing with the statutory requirements, the next two sections deal respectively with quantities up to 3 gallons and up to 60 gallons. Section IV covers filling stations and Section V is devoted to distribution and bulk storage depots. There are five appendixes which discuss tank design and siting, pipe fittings, electrical apparatus, first-aid fire extinguishers, and the flash point of various substances.

Copies are obtainable, free, on application to the Association at 15 Queen Street, London, E.C.4.

Index of Technical Articles

The first number of this new periodical, which is to be published monthly by Iota Services Ltd, 38 Farringdon Street, London, E.C.4, is dated February 1957. Its 103 pages

contain details of technical articles published in a large number of journals covering every sphere of technical activity including such things as accountancy, aeronautics, automation, chemical engineering, chemistry, economics, food, fuel, petroleum, road construction, shipbuilding, etc. The index is classified in a specially modified version of the U.D.C. system and each entry gives the title and author of the article and the reference to the journal in which it appeared. When the title is not self-explanatory, a brief sub-title is included. An author index is provided. Subscription price is six guineas per year or three guineas for six months.

Air Travel

"The air in the service of mankind" is the theme behind the latest Shell Film Unit production *Song of the Clouds*, a theme which originated from a suggestion made by the International Air Travel Association in 1955. The production involved the crew of four in some 75,000 miles of travel, with 250 hours of "operational" flying, and the shooting of about 50,000 feet of film to obtain the 4000 feet used in the picture.

The result is a striking tribute to the way in which air travel is organized for the benefit of the traveller. Currency, language, and such matters are all so well taken care of that a journey around the world, changing from one country to another and from one airline to another, can be more easily arranged than a railway journey across Britain.

The film shows how people of all nationalities and of all classes are becoming air conscious. There are also many interesting shots of the passing scene—the crater of Popocatepetl, the source of the Blue Nile, etc. In Eastman Colour and lasting 36 minutes, this film is distributed by the Petroleum Films Bureau (London) and the Scottish Films office (Glasgow).

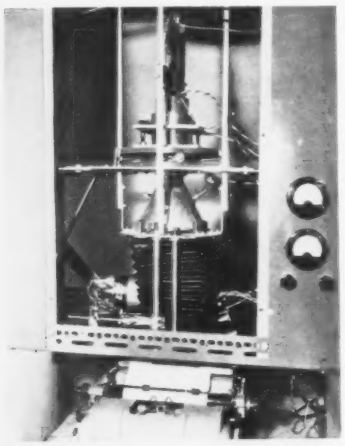
Song of the clouds.

As a "curtain raiser" when this film was given its première, the Shell Film Unit's first film, made in 1935, was screened. Entitled *Airport*, it is an historical record of what was then London's international airport—Croydon. It took one back to the days when Imperial Airways was using four-engine biplanes on the London–Paris run. The 17 minutes of some of the past is also well worth seeing.

SOLARTRON ERA

An "Eye" for the Computer

To keep high-speed computers working at maximum speed has in the past been almost impossible on account of cost. The reason for this is that the computer receives its input from an electric typewriter, a punched card, a punched tape, or a similar device. These devices are dependent upon the human eye as the reader or the human finger to typewrite or punch, and so on. Thus, to satisfy the input demands of the computers operating in the U.K. alone would cost enormous sums of money.



A general view of the character-scanning component of ERA.

This problem has now been solved by Solartron Electronic Business Machines Ltd, who have developed a device—the Solartron ERA (Electronic Reading Automaton)—which can recognize and decipher figures and letters at high speeds. The original document need not be typewritten or printed in any special type face—ERA can deal with a wide variety of type faces and can "read" papers, stock cards, tickets, cash-register rolls, or any other form of document.

It is emphasized that ERA is an "eye" only, its purpose being to convey the data it reads to the machine that can use it, and to do this at a speed otherwise unobtainable. For example, it is estimated that it can punch cards, when arranged to do so, 144 times faster than a human operator working at 300 cards an hour.

At a recent demonstration of the pilot machine at Goodwyns Place, Dorking, speeds of 120 characters per second were in use. The speed will shortly be increased to 200 characters per second, and the production model is expected to have a speed of 600.

There seems to be no limit to what a machine of this type can do, and Solartron claim that they are ahead of the rest of the world in this development.

Various types of ERA will be available and the cost will be from £20,000 to £50,000 depending largely on input volume.

Trade Literature etc.

Weir Auxiliaries

Three Weir horizontal geared turbines have been installed to drive the cargo oil pumps in the *Beaufort*, the 18,000-ton turbine-driven Norwegian tanker, built by Kaldnes Mek Verksted A/S.

Both this tanker and the Canadian Pacific liner *Empress of England* have been fitted with Weir regenerative condenser and closed feed systems, and Weir sea-water evaporating and distilling plant to supply the ship's fresh water requirements for all purposes.

The Solartron Automatic X-ray Spectrometer

An automatic X-ray spectrometer, which may be used in the laboratory or installed in the production line for the continuous analysis of production samples, has recently been introduced by The Solartron Electronic Group Ltd, Thames Ditton, Surrey.

Claimed to have an extremely wide field, it is particularly useful for the non-destructive analysis of unknown materials, the detection of impurities in solids, liquids, and gases, and the quantitative analysis of most metals and alloys.

Computing Service

At their London Computer Centre, 21 Portland Place, London W.1, where a Pegasus is installed, Ferranti Ltd operate a computing service. Routines are available for the calculation of a wide range of standard mathematical functions and there are a number of programmes for the solution of standard scientific, industrial, and statistical problems. Assistance is given in training personnel to write their own programmes and run them on the machine.

Further information can be obtained from the Sales Manager at the address stated.

Water Removal from Lubricants

Despite efforts to provide air-tight bungs, all barrels of oil breathe as the ambient temperature fluctuates. If the air drawn into the barrel (during a rise in temperature) has a high humidity, some moisture will condense out (inside the barrel) as the air cools. Should rain water be allowed to collect in the barrel head and cover over the bungs, some water will likewise be drawn into the barrel.

A useful Industrial Technical Bulletin, which explains this phenomenon and also how to deal with it, has recently been published by Mobil Oil Co Ltd, Caxton House, Westminster, London, S.W.1.

New Fire-fighting Hose Reel Unit

The Pyrene Co Ltd have introduced a new fire-fighting hose reel unit which is claimed to be particularly suitable for outbreaks involving combustible material, such as wood, paper, cloth, and upholstery, where a cooling or wetting agent is required.

One of its features is that it embodies a unique device which enables the hose to be run out in any direction without the obstruction of swinging joints.

Enquiries in regard to this unit should be addressed to The Pyrene Co Ltd, 9 Grosvenor Gardens, London, S.W.1.

Stream-flo Check Swing Valves

The manufacturers, Charles Wheatley Company, claim that these valves, which have working pressures up to 10,000 psi and are made in a variety of metals and alloys, are characterized by simplicity of design and long dependable service. Moreover, they take advantage of improved quality "O" ring seals and are constructed in accordance with API specifications, *i.e.* face to face dimensions are the same as any other standard check valve. The remote control type may be operated by air, gas, or fluid.

Bulletin No. 1056, which outlines these and other characteristics, may be obtained from Oil Well Supply Co Ltd, 5 Queen Street, London, E.C.4.

Colloidal Graphite and "dag" Dispersions

The properties, characteristics, and advantages of colloidal graphite have recently been outlined in a useful pamphlet, "Colloidal Graphite—What is it?", which is available on application to Acheson Colloids Ltd, 18 Pall Mall, London, S.W.1.

The manufacturers state that "dag" colloidal graphite is especially suitable as a "wetting" agent for chromium and alloy steels, and is not intended to replace oil but to work with it.

The company has also issued a summary, entitled "'dag' Dispersions", of the main uses and purposes of these dispersions in production lubrication, manufactured products, and maintenance and operational lubrication.

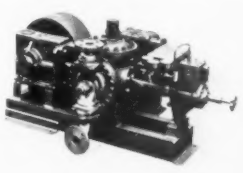
Laboratory Apparatus Display

To mark the occasion of the opening of new showrooms at Spenser Street, London, S.W.1, Measuring and Scientific Equipment Ltd is arranging a display of its entire range of laboratory centrifuges, microtomes, homogenizers, and blenders.

This special display will be open throughout May between the hours of 10 a.m. and 5 p.m., excluding Saturdays and Sundays, when the Company's sales and technical staff will be available to advise visitors.

Pumps for the Petroleum Chemical Industry

Glandless piston diaphragm pumps, with fluid ends which can be made in metals or plastics that will resist the corrosive action of whatever fluid is to be pumped, are now available to meet the special requirements of the petroleum chemical industry.

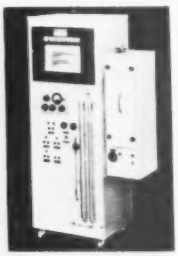


Claimed to be capable of withstanding pressures up to 2000 psi, the manufacturers state that the single units have capacities up to 500 gallons per hour and the double and treble units up to 2000 gallons per hour.

A single flameproof motor can be arranged to drive each pump unit through a variable speed gear, coupled to a pneumatic positioner which is, in turn, controlled by a process variable. Further details may be obtained from E.C.D. Ltd, Tonbridge, Kent.

Vapour Phase Partition Chromatography

In this recently developed method of analytical analysis, the components of the vaporized sample (in one method of detection) affect the electrical resistance of a hot wire as they emerge from a chromatographic column. The changes in electrical voltage thus produced are measured by, and are automatically recorded on, the moving chart of a recorder.



The success of the process depends critically on the speed and accuracy of the measuring and recording equipment used. It is claimed that this need has been met by the development of electronic "continuous balance" potentiometer recorders (manufactured by Honeywell-Brown Ltd), which are now supplied as standard components by two principal manufacturers of vapour phase partition chromatographic equipment.

Heat Transfer Sheets

A new type of heat transfer sheet, in which the passageways are integral with the sheet, has recently been introduced by Imperial Chemical Industries Ltd.

At present available in sizes up to 100 x 15 x 0·06 inches, the sheets have many important applications, including domestic refrigerator evaporators.

The passageways are obtained by first printing, with a special "stop weld" ink, the required pattern on to one side of a sheet of aluminium. By cold rolling this sheet (under very heavy pressure) with another sheet of the same size, the two sheets are made to weld together—excepting in those places where the first sheet was printed. Having done its job, the "stop weld" volatizes and escapes from between the sheets during the subsequent annealing process. The unwelded portions are then forced apart by applying internal pressure to form a continuous circuit.

Further details will be supplied on application to I.C.I. Ltd, P.O. Box 216, Witton, Birmingham 6.

Equilibrium Flash Calculations

A new equilibrium-flash sliderule, which is claimed to enable flash, bubble point, and dew point calculations to be made to a high degree of accuracy in less time than is required for present mathematical procedures, has recently been introduced by The M. W. Kellogg Company, New York.

Calculations may be started with any arbitrarily assumed value of the per cent vaporization using the sliderule. Succeeding equilibrium flash trials can then be made quickly until the final solution is reached. The essence of the method is that trial values to be assumed are automatically derived from the discrepancies found as the results of preceding trials.

Qualified engineers who write on company letterhead to The M. W. Kellogg Company, 711 Third Avenue, New York 17, N.Y., will be sent a complimentary sliderule with directions for its use.

The Lifelines of Pipelines

This profusely illustrated brochure describes the automatic telephone network of Shell Venezuela's Western Division, a network which has been installed in recent years by Philips' Telecommunication Industries in close co-operation with the telecommunication experts of the Royal Dutch/Shell Group.

Before world war II, a manual exchange originally handled the telephone traffic on the oilfields. In 1935, a 24-volt system with 300 extensions was installed in the main office at Maracaibo, with an operator's desk for handling the incoming exchange-line traffic and the connexions with the oilfields. The story of the modernization of the system with full mechanization of telephone equipment, the substitution of buried cables for open wire connexions, radio equipment, etc. is indeed a fascinating one.

Among the illustrations is a night view of the Shell Refinery at Punta Cardón.

The brochure is issued in co-operation with telecommunications engineers of the Royal Dutch/Shell Group of Companies by N. V. Philips' Gloeilampenfabrieken, Telecommunication Division, Hilversum, Netherlands.

ESSO PETROLEUM COMPANY LIMITED
has further vacancies at Fawley Refinery for Science Graduates (with or without industrial experience).

Fawley is situated on the west side of Southampton Water, on the borders of the New Forest. Since 1949 there has been a programme of continuous development and expansion of Refinery capacity, and by 1958 the capital expenditure involved will have reached £68 millions.

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The above posts carry responsibility for studying and advising on process unit operations, and allied planning, economic and engineering design problems. Continued expansion of the refinery gives excellent prospects for advancement and the jobs themselves are professionally satisfying. Graduates are given opportunities for fitting themselves for wider responsibilities by various forms of training, *e.g.* technological courses, rotation between different jobs, and management training.

Commencing salaries for all posts depend on age, qualifications, and experience. All posts are progressive. There is a voluntary contributory Pension Plan, which is amongst the best and most comprehensive of such schemes. Working conditions are congenial in a modern industrial setting. There are excellent recreational facilities of all kinds. All enquiries will be received in strict confidence, and should be sent to the Employee Relations Superintendent at the above address marked "Technical Staff Recruitment".

Industrial Reconnaissance

No Planned military operation takes place without careful probing of the tactical position. Similarly no soundly conceived plan of industrial development can proceed before adequate surveys have been undertaken. So logical is this that its statement seems superfluous. Yet every year hard earned capital is wasted by drills that grind expensively into disappointing substrata. A geophysical survey, expertly conducted, greatly reduces these preliminary risks and directs the way to a speedy conclusion of the development phase.

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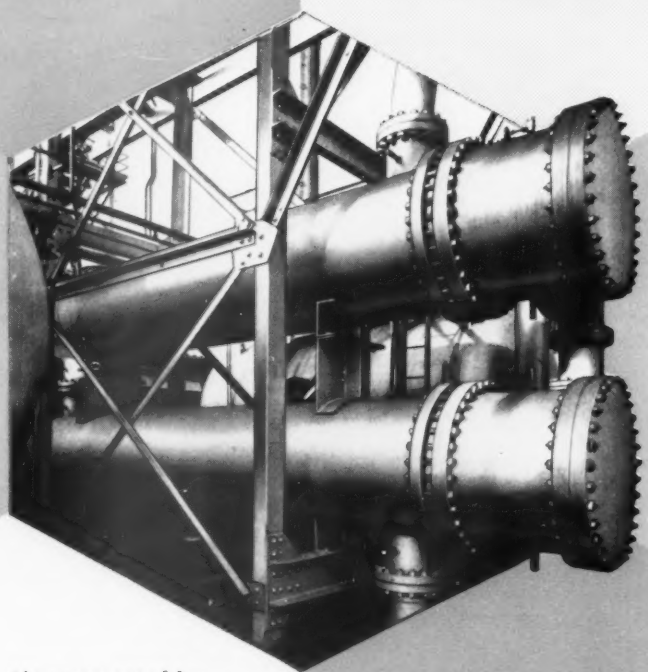
Advertisers

	PAGE
Anchor Chemical Co Ltd	xv
Audley Engineering Co Ltd	xxx
E. B. Badger & Sons Ltd	Inside Back Cover
British Petroleum Co Ltd, The	x
British Thomson-Houston Co Ltd, The	ix
Causeway Reinforcement Ltd	Apr.
Consolidated Pneumatic Tool Co Ltd	viii
A. F. Craig & Co Ltd	xix
Dewrance & Co Ltd	Mar.
Dorr-Oliver Co Ltd	xxv
Electrothermal Engineering Ltd	vi
Elliott Bros. (London) Ltd	—
English Electric Co Ltd, The	xxvii
Esso Petroleum Co Ltd	—
Evertaut Ltd	xxii
Fischer & Porter Ltd	Apr.
Fisher Governor Co Ltd	Apr.
Fothergill & Harvey Ltd (Tyglas)	Mar.
W. J. Fraser & Co Ltd	Apr.
A. Gallenkamp & Co Ltd	vi
Geophysical Prospecting Co Ltd	xvii
Matthew Hall & Co Ltd	Inside Front Cover
John Harper & Co Ltd	xi
W. C. Holmes & Co Ltd	xxvi
Honeywell-Brown Ltd	Apr.
Hydronyl Syndicate Ltd	Apr.
International Paints Ltd	vii
A. Johnson & Co (London) Ltd	Apr.
Kellogg International Corporation	iii
Kelvin & Hughes (Industrial) Ltd	—
Lake & Elliot Ltd	xvii
J. Langham Thompson Ltd	xii
London & Thames Haven Oil Wharves Ltd	xxi
M & C Switchgear Ltd	xxxi
A. & J. Main & Co Ltd	Mar.
Marconi's Wireless Telegraph Co Ltd	iv
Metal Containers Ltd	Back Cover
Metal Propellers Ltd	Mar.
Metropolitan-Vickers Electrical Co Ltd	Apr.
Moon Brothers Ltd	Apr.
Motherwell Bridge Contracting & Trading Co Ltd	xxxii
Nu-Swift Ltd	ii
Ralph M. Parsons Company	Jan.
Peirson & Co Ltd	xiv
F. Perkins Ltd	Apr.
Petroleum Inventions Ltd	xxiv
Petrolite Corporation	xxix
W. Press & Son Ltd	xxxiv
Pyrene Co Ltd	xxii
John Rabone & Sons Ltd	xxviii
Serck Radiators Ltd	Apr.
Shell-Mex & B.P. Ltd	xxxiii
Shell Chemical Co Ltd	xviii
Simmons & Hawker Ltd	xv
Peter Spence & Sons Ltd	xvi
Swarts and Lloyds Ltd	v
Stothert & Pitt Ltd	—
Taylor-Short & Mason Ltd	xx
Trent Valve Co Ltd	—
United Steel Companies Ltd, The	xiii
C. C. Wakefield & Co Ltd	Mar.
West's Piling & Construction Co Ltd	Apr.
Whessoe Ltd	xxiii

WHESSOE HEAT EXCHANGERS

WHESSOE HEAT EXCHANGERS



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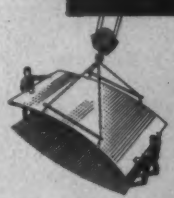

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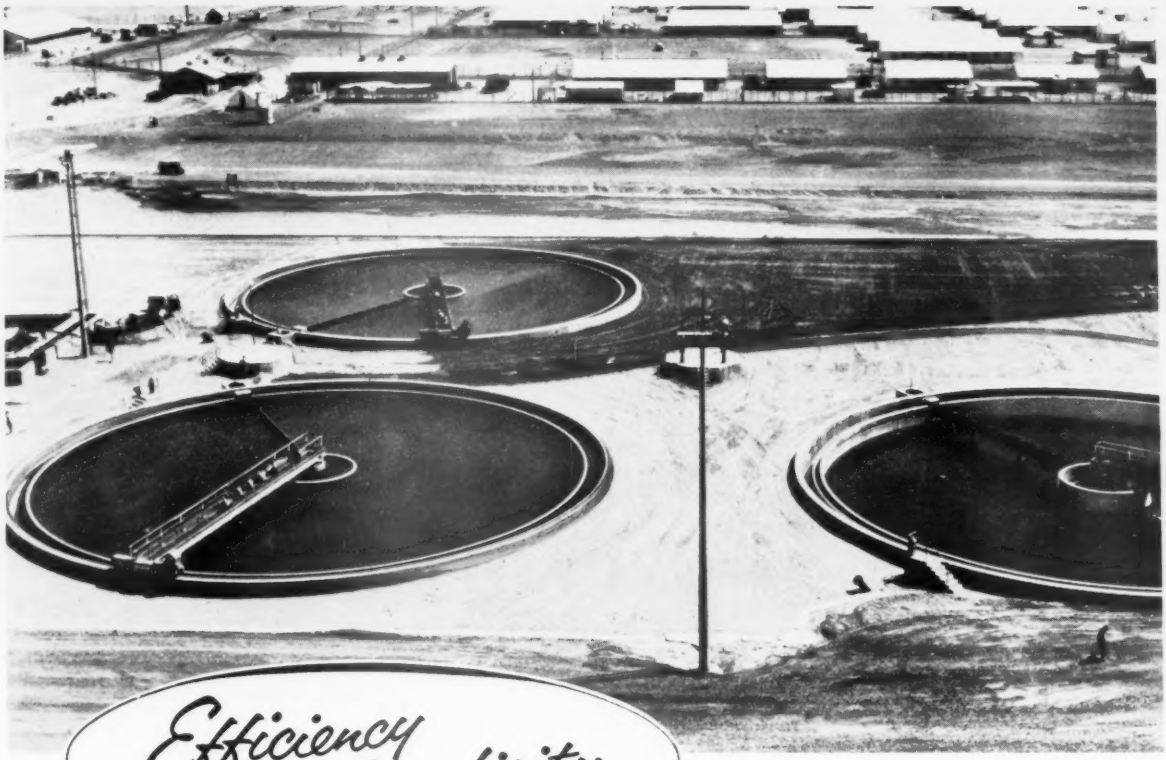

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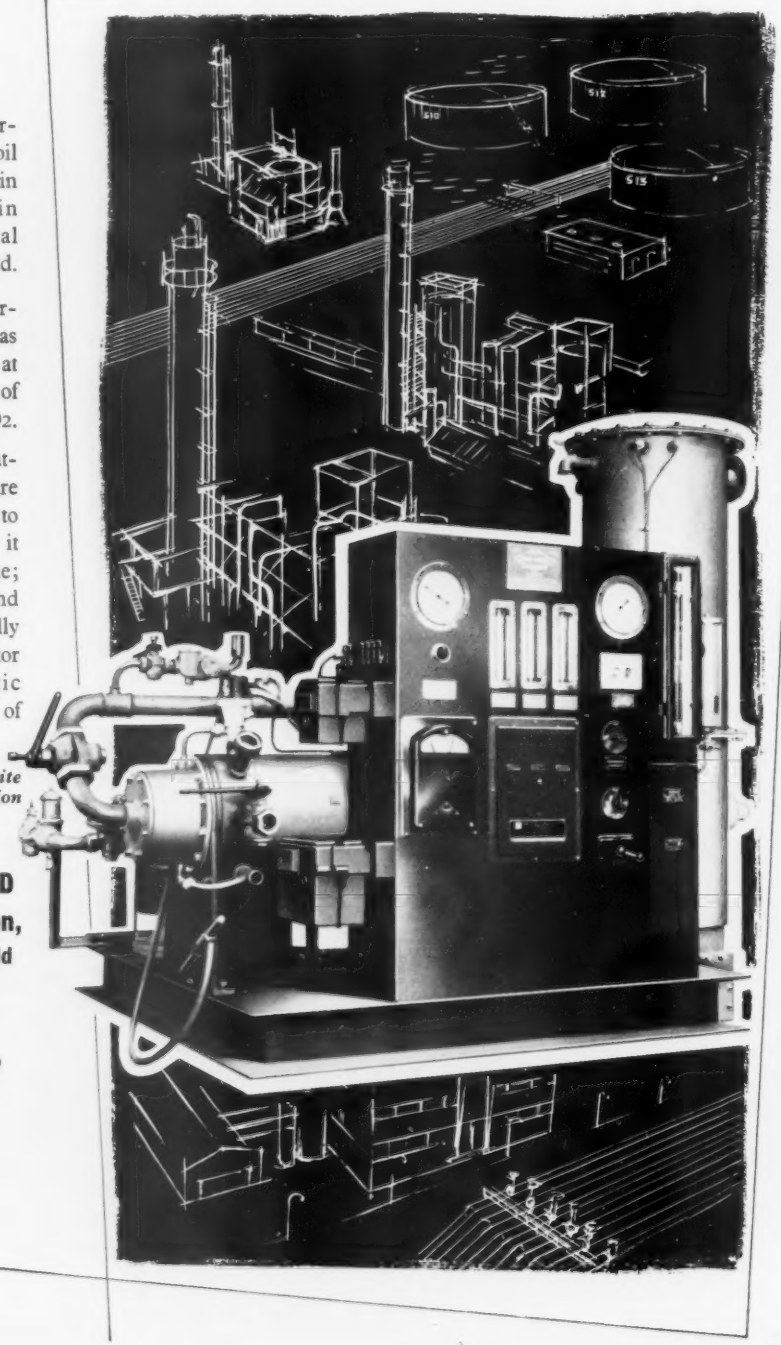

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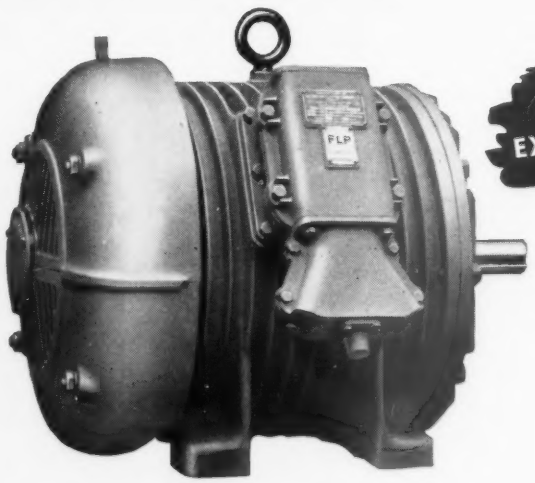

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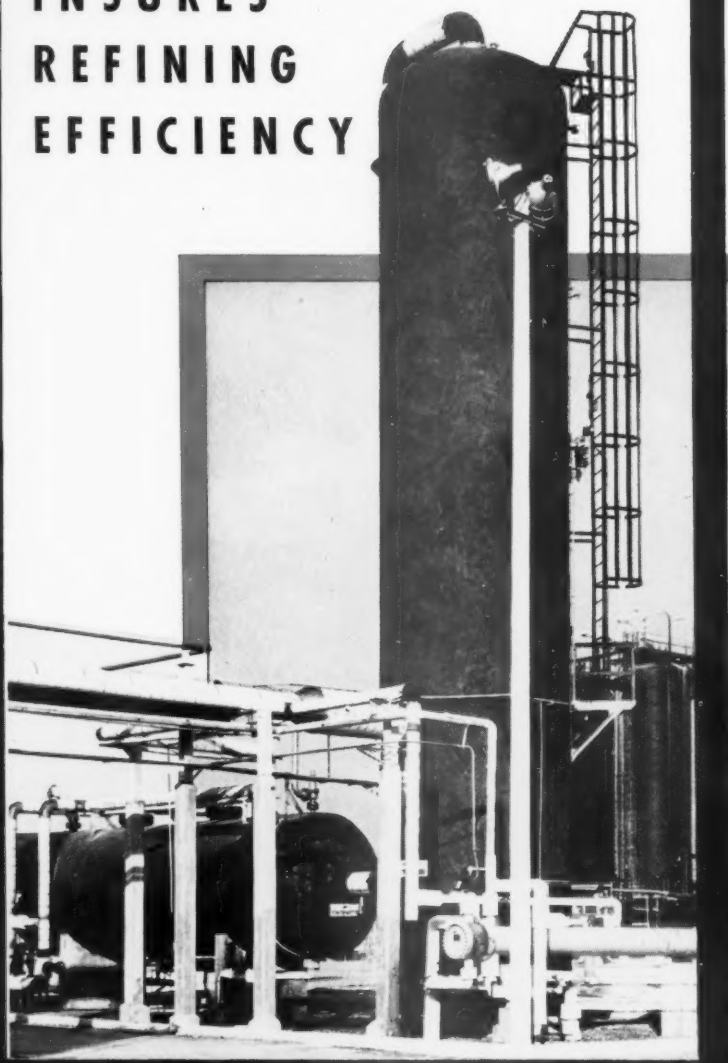

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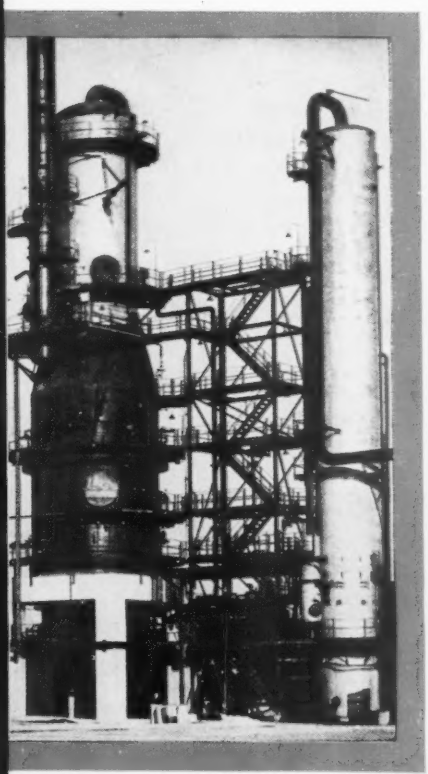

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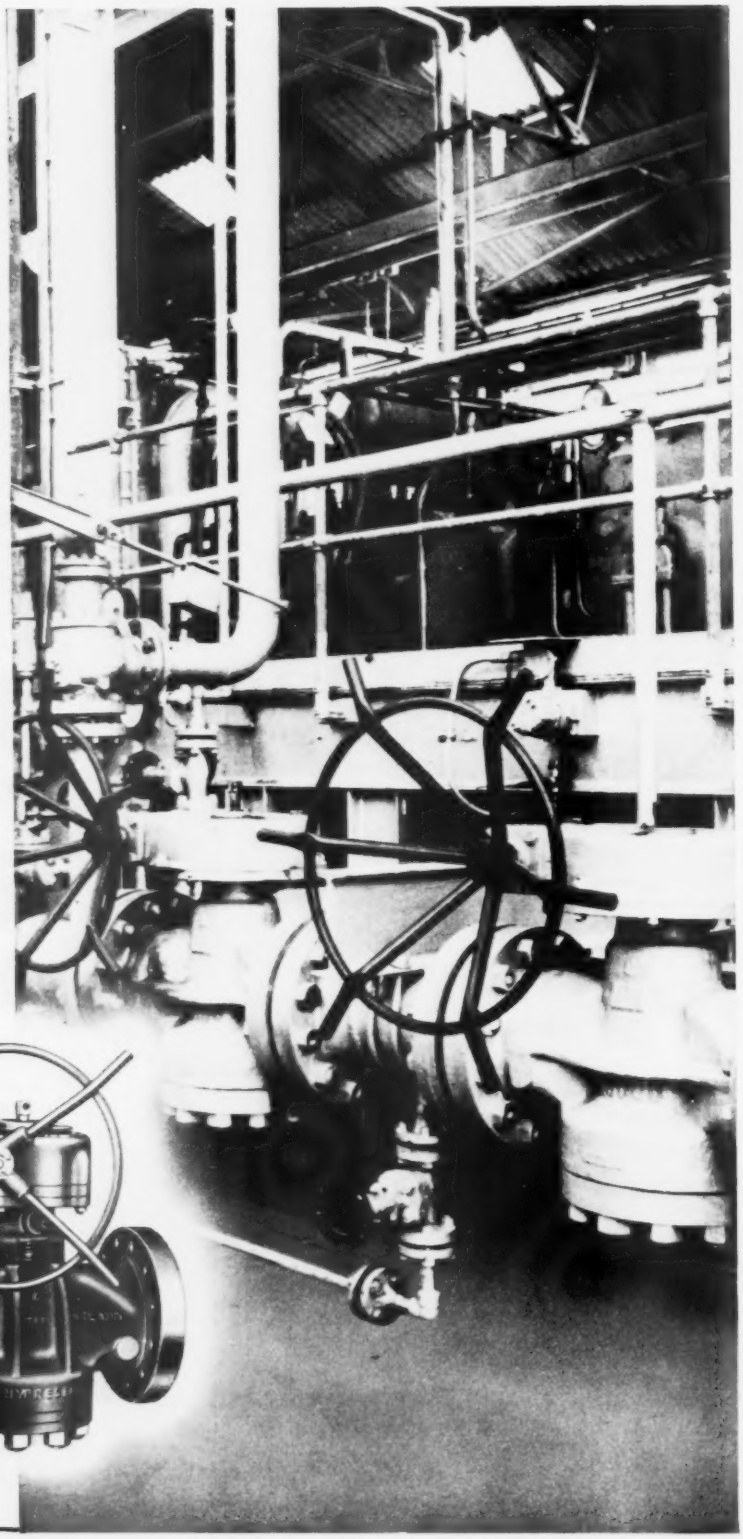

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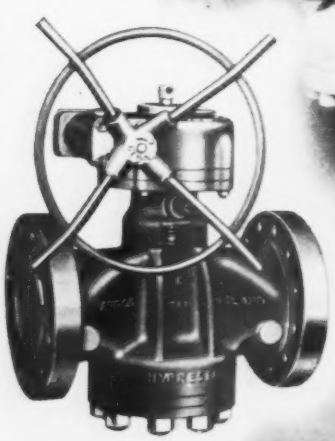

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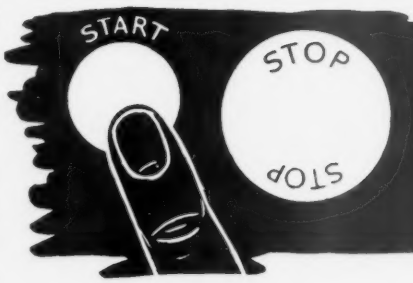
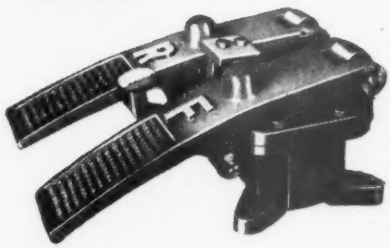


PUSHBUTTON SWITCHES

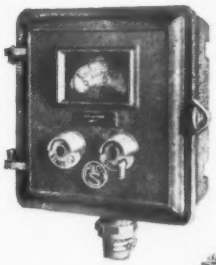
FLP

Flameproof 2-Point start/stop switch with ammeter. Tropicalised ammeter can be provided.

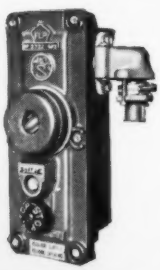


Hoseproof Twin Pedal Control switch for use in conjunction with a contactor starter. Arranged for forward and reverse operations.

2-Point start/stop switch with ammeter.

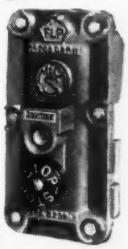


Flameproof 2-Point start/stop switch with indicating lamp.



2-Point start/stop switch.

Flameproof 2-Point start/stop switch.



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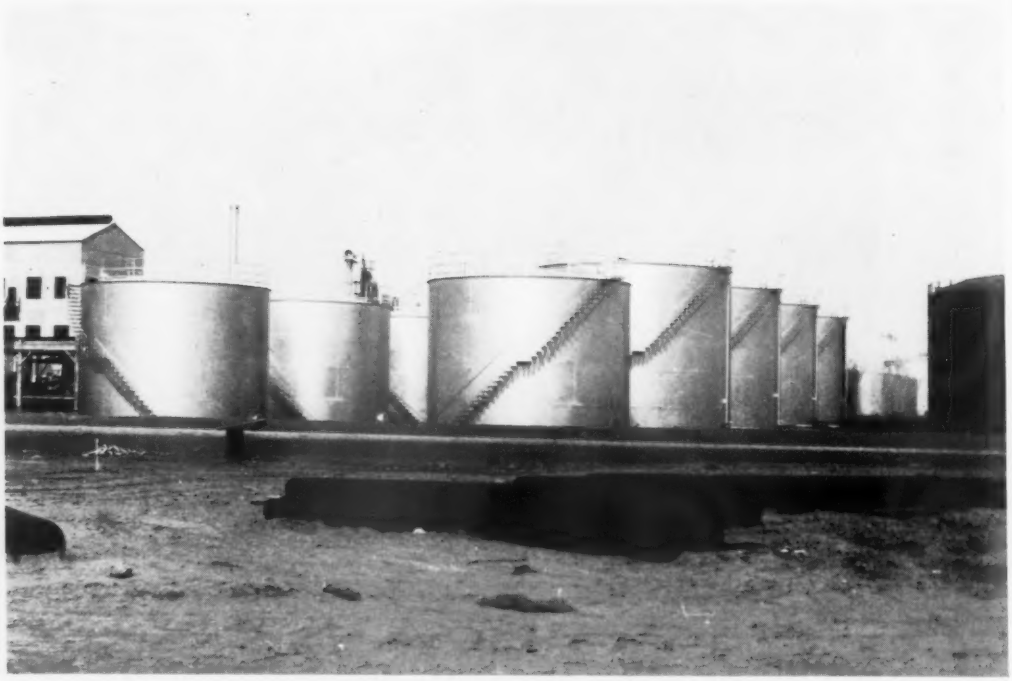

Tanks erected for Messrs. Foster Wheeler for the new Lubricating Oil Plant at the Iraq Government Refinery, Daura, Baghdad.

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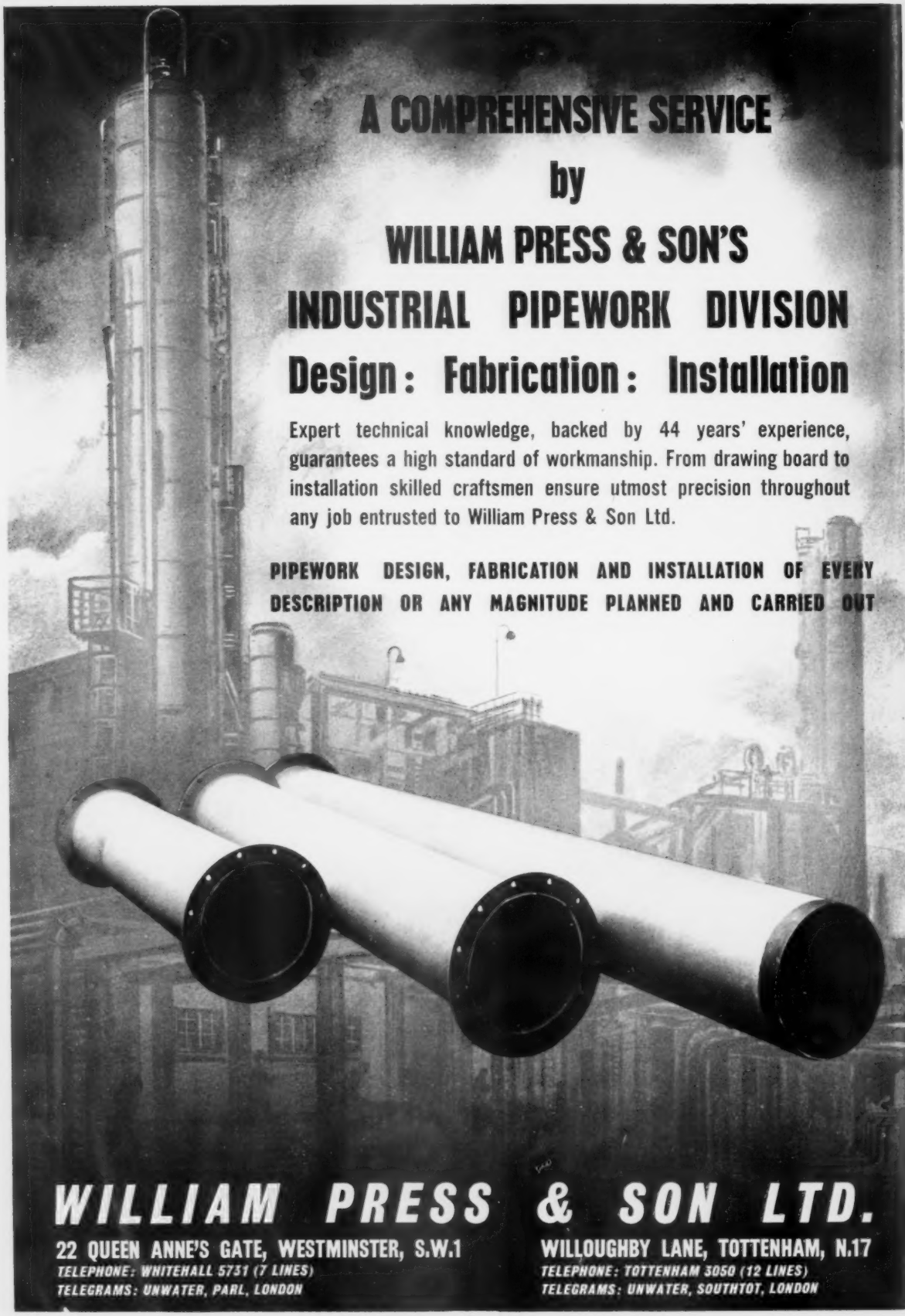
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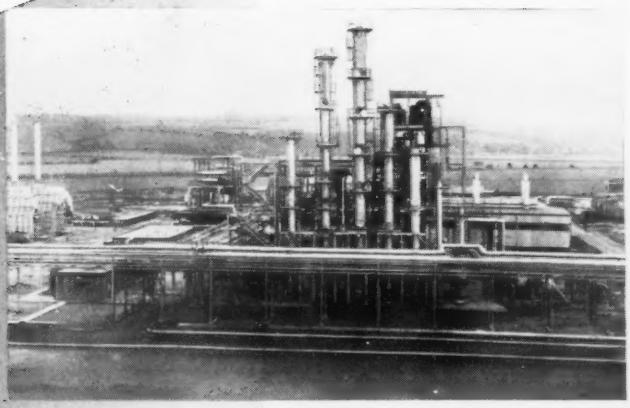

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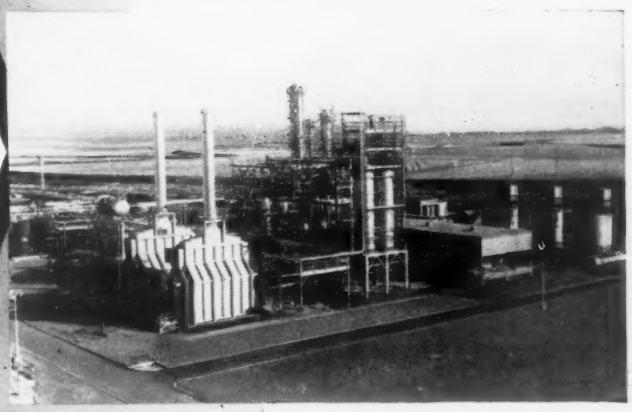
(By Courtesy of British Hydrocarbon Chemicals Ltd.)



* SYNTHETIC ETHANOL—U.K.
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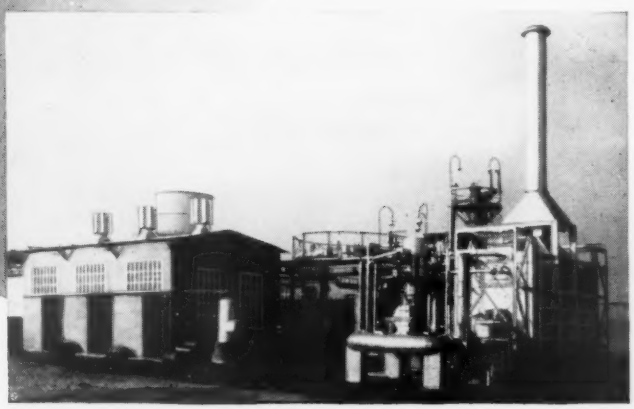

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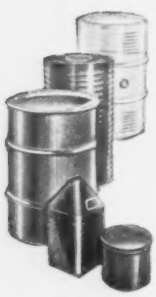

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